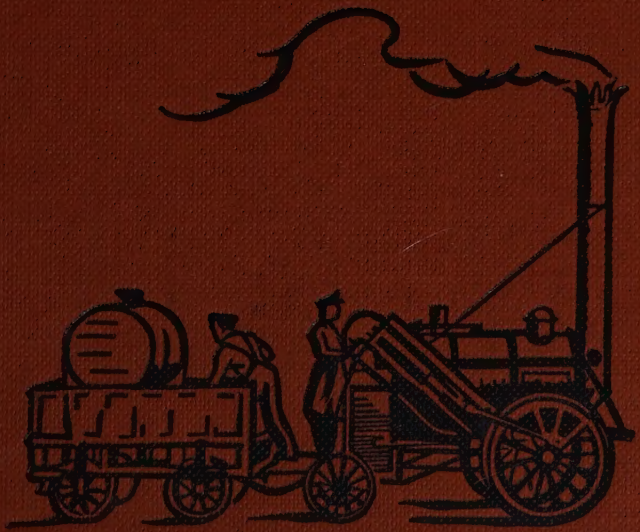

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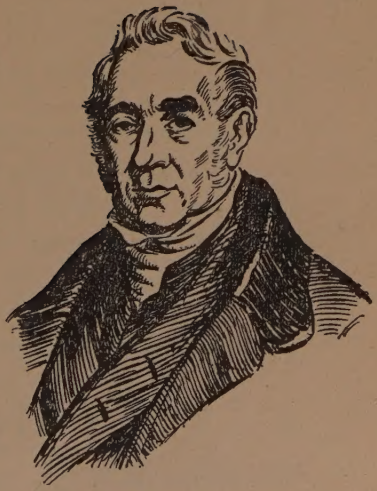
The Railway builders [by] Emmeline Garnett.
Illustrated by Wardill. [London?]
Hodderand Stoughton [1952]
231 p.

1. Railroads - Great Britain - Hist.
2. Stephenson, George, 1781-1848.
3. Stephenson, Robert, 1803-1859.
I. Garnett, Emmeline, 1924-

THE
RAILWAY BUILDERS

Robert Stephenson



George Stephenson

By the same author

THE SCARLET SNUFFBOX
DRAGON FARM

EMMELINE GARNETT

THE RAILWAY BUILDERS

Illustrated by Wardill

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HODDER AND STOUGHTON

First published 1952

Printed in Great Britain
for Hodder & Stoughton Limited
by Richard Clay and Company, Ltd.,
Bungay, Suffolk

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30181
R3X

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CHAPTER I

THE COLLIERY BOY

At the end of the eighteenth century the coal country of Northumberland and Durham was only black in patches. The coal-beds had been known and worked for hundreds of years, at first in open pits, later by underground tunnelling, but there was not yet any machinery for extensive and elaborate mining. Newcastle was quite a little town, Gateshead a mere village, and although there were shipyards and quays, landing stages and rubbish-tips along the banks of the Tyne, these were insignificant against the green fields and heathery moors.

In the old days the coal had been carried from the pits to the river-side on pack-horses, but with the new mills and factories demanding more and more coal to drive their machinery, some quicker method of transport had to be used. Road-building was a lost art (no one had built a really good road in England since the Romans left), so the mine-owners laid down railways, on which wagons could run more easily than among the deep ruts of the public high-roads. Tracks of wood or iron, just the width of the wagon-wheels apart, were let into the ground, and on them a single horse could draw two and a half tons, against the half ton that was all it could manage on the road. Sometimes the tracks were raised instead of inlaid, and then the wagon-wheels were made with flanges so that they could not slip off. Everywhere in the coal-country these tramways were to be seen, and the long trains of wagons, plodding down to the Tyne, were a familiar sight.

At the river-side the coal was emptied into dumpy, flat-bottomed little boats called keels, with square black sails, which floated it down with wind and tide to Newcastle. The bridge at Newcastle was too low for sea-going boats to pass, so the keels took it that far, and then it was trans-shipped and

taken south by sea. Coal was such a heavy, awkward commodity that water transport was the only possible means of conveying it. It was never by any chance taken for long distances by road, and until the railroads, or tramways, were built, it was only the mines near the river that prospered. Londoners were so used to their coal coming to them through the Thames-side docks, that for a very long time they always referred to it as " sea-coal ".

The Northumbrian coal-fields were like no other place in

A Northumbrian Pit-head

England, and visitors found the pits weird, exciting and exceedingly picturesque. The wild moorland country, with its stone dykes and its bogs, was unusual enough, and then suddenly to find, set down in these surroundings, the blackened buildings of the pit-head, the " insane wheels and machinery possessed by riotous spirits ", as one stranger expressed it, was more than impressive.

It was like being in another land altogether. The pitmen spoke a dialect incomprehensible to the ordinary Englishman, and they were dressed in a fashion of their own, in check flannel jackets and trousers, with all the implements of their

trade slung about them, their picks, bunches of candles, water-bottles, and satchels for food.

"At all hours, night and day, groups of men and boys are seen, dressed in this fashion, wending their way to their colliery. . . . They descend the pit by means of a basket or 'corfe', or merely by swinging themselves on to a chain, suspended at the extreme end of the cordage, and are let down, with inconceivable rapidity, by a steam engine. Clean and orderly, they coolly precipitate themselves into a black, smoking, and bottomless-looking crater, where you would think it almost impossible human lungs could play, or the blood dance through the heart. At nearly the same moment, you see others coming up, as jetty as the object of their search, drenched and tired.

"I have stood in a dark night, near the mouth of a pit, lighted by a suspended grate, filled with flaring coals, casting an unsteady but fierce reflection on the surrounding swarthy countenances; the pit emitting a smoke as dense as the chimney of a steam-engine; the men, with their sooty and grimy faces, glancing about their sparkling eyes, while the talking motion of their red lips disclosed rows of ivory; the steam-engines clanking and crashing, and the hissing of the huge boilers, making a din, only broken by the loud, mournful, and musical cry of the man stationed at the top of the pit shaft, calling down to his companions at the bottom."

This romantic impression of the pits was written by a visitor at the beginning of the nineteenth century. The men he saw were a tough, big-boned race, who did not inter-marry much with the families of the surface workers, but remained a race apart, wild and uncouth. They worked down the pit for more than twelve hours a day, going down at two or three o'clock in the morning and coming up "to grass" again in the afternoon. Their life was hard and dangerous, but it was not nearly so hard as some modern social histories would have us believe.

There was so far no machine invented that could take the place of men with pick-axe and shovel, and so throw

people out of work, as the cotton machinery had thrown thousands out of work in Lancashire. Nor were they threatened by swarms of starving Irishmen, who were willing to live like pigs on a less than living wage. The miners' pay was high, and although they were hard workers when they chose to work, they were also difficult to manage, and frequently went on strike, secure in the knowledge that there were none too many of them, and that no one else could undertake their peculiarly skilled work. Sundays, and the fortnightly Saturdays when they were paid, were spent in a riot of drinking, wrestling, fighting, poaching, donkey-racing and dog-fighting, to the alarm and disgust of their more respectable neighbours.

They were to a certain extent a rootless people, for the work shifted, and they had to follow it. There were some mines which were permanent, and large villages grew up round them, but many more lasted only for a few years. A pit was sunk, the winding-gear installed, a row of cheap cottages erected in which each man, no matter the size of his family, was allotted one room. Within a few years the seam was worn out or too dangerous to work further, and a new pit was sunk somewhere else. The miners and their families left, the shaky little houses fell down, grass and nettles grew over the tips, the paths were obliterated, and the old mine was forgotten.

Robert Stephenson was a colliery worker, but not a pitman. He was a "pit-brow man", a fireman on one of the steam pumping-engines, and his wage was twelve shillings a week, out of which a deduction was made for rent and coal. He was born about the middle of the eighteenth century, and married in 1778. During the next fourteen years six children were born, so that at one time, after the last baby was born and before the elder boys left home, there were eight people living in the single room.

It was, like many other colliery homes, one room in a four-roomed cottage, with mud floor and plain raftered ceiling. There was a well and a rather primitive privy at the back, but there was also a garden, and green fields all round—plenty of space and fresh air outside, even if there was not much inside.

Most of the room was filled by three beds, separated from each other by bits of curtain. In one slept Robert and his wife, in another the four boys, and in the third the two girls. There was a table, a chair or two (the children ate their meals standing round the table), a chest to hold their Sunday clothes, and a shelf of crockery. All the cooking was done in a single black iron pot slung over the fire. There was no oven to roast meat, but then meat rarely came in the way of a twelve-shilling-a-week workman, and when it did it was only a piece of bacon which could boil in the pot along with the potatoes and cabbage. The family's chief food was "crowdy", a kind of porridge made of oatmeal stirred smoothly into hot water. This half-cooked concoction needed a strong stomach to digest it, but it was satisfying and nourishing food for hard-working men and growing children.

Wheat was too dear for poor families. In 1780 the average price was four shillings a quarter, but after the beginning of the war with France it rose higher and higher, and in 1800 stood at eight shillings, almost a famine price. So crowdy and milk, oatcake and vegetables, bacon and small ale, was the normal fare, and the young Stephensons grew and thrived on it.

There was no schooling for any of them. Their parents could not read, or very little, and certainly could not write. Robert Stephenson owned a Bible, it is true, which occupied a proud position in the house, but that was chiefly for show and because "t'owd Book" was a respectable thing to have in a home. When he wanted to make a list of his six children on the fly-leaf, he had to dictate the entries to a more learned friend, whose spirit was willing, but whose spelling was decidedly wobbly.

This was the result:

"A Rechester of the children belonging Robert and Mabel Stepheson—

James Stepheson Was Born March the 4 day 1779
George Stepheson Was Born June 9 day 1781
Elender Stepheson Was Born April the 16 day 1784

Robert Stepheson Was Born March the 10 day 1788
John Stepheson Was Born November the 4 day 1789
Ann Stepheson Was Born July the 19 day 1792."

As the elder boys started work at eight or nine years old, there were never six children dependent on the twelve-shilling wage at once, but even so the babies came so close together that life was very hard. Even among their poor neighbours they were looked upon as " honest folk, but with very little to come and go upon ".

To people who knew nothing better, and who had few richer neighbours to envy, it was not a miserable life, and with the Stephensons at any rate it was not a sordid one. Mrs. Stephenson was a good woman who kept her house clean and her family warm and tidy. There was enough to eat although it was coarse and monotonous fare, and there was always plenty of fuel to keep a good fire on the hearth. She brought up her children to work hard, fear God, and ask for no man's charity, and the strong affection between all the family made the home comfortable.

Robert himself was an honest, kind man, who loved children and loved the country. Like so many pitmen, he kept dogs, rabbits and other pets, and tamed robins and blackbirds with scattered crumbs. He took his children out for walks on Sunday afternoons, and all his life George remembered the thrill of being lifted up by his father, to look at a nest full of young blackbirds. A gentle, unassuming man, Robert never got beyond a fireman's work and a fireman's wage, but everyone liked him, and in his slack hours, beside the red glow of his engine-fire, he entertained all the children of the village with what he remembered of Sinbad and Robinson Crusoe, and even more marvellous tales of his own invention, so that they always thought of him, long after he was dead, as " Bob the Story-teller ".

The children were put to work as soon as might be. When he was eight George was earning a shilling a week minding the cows of a neighbouring farmer which grazed along the

tramway. The iron rails ran through the village from the colliery, and passed right in front of the Stephensons' cottage —High Street House—and then out into open country, following the Tyne for five miles until they reached the staithes where the keels came to load. The work was not hard for a boy who was used to being out in all weathers. All he had to do was to watch that the beasts did not stray on to other people's land

High Street House

nor get in the way of the coal-trains, and to see that the gates were fast after the last wagon had passed at night. Barefooted and touzle-headed, as brown as a gipsy with wind and sun, Geordie spent most of his time scouring the hedges for birds' nests, flowers, and blackberries, climbing trees, making whistles out of reeds, and building mud harbours and dams in the beck. But he did not neglect the cows, for he was a boy with a conscience.

All the time that he was a farmer's boy he looked forward

eagerly to the day when he would be old enough to work at the colliery with his elder brother James. James was a " corf-bitter." When the corves, or wicker baskets, full of coal were hauled to the pithead, his job was to pick out bits of stone and rubbish before the coal was loaded into the wagons.

It was not only because James earned his three shillings a week that Geordie envied him. To be a corf-bitter was the first step on the road to being a fireman, like his father, and there was no one in the world quite like his father. Before he became a working-man at twopence a day, Geordie used to go up to the pit every midday with his father's dinner, and linger there all the afternoon if he could. There was a fascination in the glowing furnace and in the snorting, puffing, rackety old steam-engine, with its huge arm plunging up and down high up in the engine-shed. Most wonderful of all was to see one of the lads, little older than himself, oiling the hinges of the pump-shafts. He climbed, oil-can in hand, up a steep ladder, and from there jumped on to the beam while it was moving. Then, quite coolly, he walked to the end of the plunging see-saw, and oiled the bearings as steadily as though he were on solid ground.

Until he could start on a career at the colliery, Geordie's favourite game was playing at steam-engines. There was a patch of damp clay at the edge of the beck, and here he used to squat for hours, making clay furnaces, boilers, and engine-houses, with hollow parsley-stalks for steam-pipes. Then he would stoke his fire with crumbs of coal, and with cries of " Haul away ! " and " Let her go ! " pull the twig levers and send imaginary loads of men and coals rattling up and down the pit-shaft.

When he was nine the cows were passed on to the care of some other boy, and Geordie went to the colliery. It was much harder work than watching the cows, but every second Saturday he queued up at the pay-office among the men, and carried six shillings home to his mother. Without any schooling at all, he had already learned one thing—that hard work was a good thing because it enabled a man to " get on ". He

was a high-spirited, noisy lad, always running and jumping, and wrestling, and cadging a ride on any pony he could find; but he knew how to work, and he got on as fast as he could. He progressed from being a corf-bitter to driving the gin-horse at a nearby pit, and although it meant walking two miles across the fields to his work, it also meant four shillings a week instead of three.

Not all the pits were supplied with steam-engines to work the winding-gear. At some the old-fashioned method was still used—a " gin ", or windlass, which a horse worked by walking in a circle. Geordie was a gin-driver until he was fourteen. Then he was given the responsible task of being assistant fireman to his father. At six shillings a week, this was real promotion, but he was always afraid that the colliery-owners would think he was too little a lad to earn such high wages fairly, and when there was an inspection he kept very much in the background, in the darkest corner of the engine-shed.

He loved the engine he worked for, and when he became a fireman on his own account he thought he should never want anything else from life.

" The working of a Newcomen engine," said someone who had watched one at work, " was a clumsy and apparently a very painful process, accompanied by an extraordinary amount of wheezing, sighing, creaking and bumping. When the pump descended, there was heard a plunge, a heavy sigh, and a loud bump: then, as it rose, and the sucker began to act, there was heard a creak, a wheeze, and another bump, and then a strong rush of water as it was lifted and poured out."

It was one of these ancient engines (for they were already long out of date) that was the pride of George's heart. He and another boy looked after it all by themselves. Twelve hours on and twelve hours off were their shifts of work, and still George spent his fortnightly half-holiday cleaning his engine, taking off every movable part, scaling and oiling and polishing and putting together again. He watched it at work like a mother with her first baby. There never was such a marvellous machine. He soon got the reputation of being a

little bit daft over his engine, but the colliery manager did not mind daftness of that sort, since his engine needed less attention from the engineer than any of the others. Geordie's wages were raised to twelve shillings a week—a man's wage, the same as his father's. He came out of the pay-office that Saturday grinning all over his face.

"I'm a made man for life," he announced to his mates in the queue, and swaggered home to astonish his mother and the children with the sight of so much wealth.

From a fireman he was made an engine-man, and so had already got ahead farther than his father and his elder brother, both of whom were only firemen, and likely to remain so. George was curious by nature, and his restless mind was never still. When anyone told him about anything that interested him, he had to try straight away to imitate it, or make a model of it, or try it out himself to see if it really worked like they said it did. He was interested in anything and everything, but chiefly in engines. He wanted to know about all sorts of engines, not just his own. He heard of the wonderful engines made by Boulton and Watt, compared with which his old Newcomen was about as effective as a whistling kettle, and he longed to see one at work and understand everything about it.

The gateway to such knowledge was reading. Everything was to be found in books, he was told. So he went to school. Three nights a week, after his twelve hours' work, he sat down to master the intricacies of the A B C. The schoolmaster was not much of a scholar himself, but he could read and write, and spell with fair accuracy, and he was willing to pass on these attainments for the sum of threepence a week.

Reading is not a difficult art for a determined person to acquire, and after a few months' persevering work with the family Bible and any stray sheet of newspaper he could find, George could read very nicely, although he had started too late in life for it ever to be a pleasure in itself. Writing was much more difficult. Apart from the vagaries of English spelling, it was not easy to cramp his hand, already broad and hard, round

a quill, and it was only after weeks and months of laborious pothooks that he attained to writing his name.

Then a better schoolmaster came to the village, one who charged a penny a week extra, but included "cyphering" in his curriculum, and George transferred to him. He found that he liked figures. He took to them like a fish to water, and every evening the master filled his slate with sums which he brought back next evening to be corrected. When the slate was full he made up sums for himself with a bit of chalk on the smooth side of a coal-wagon. By the end of the winter he was well through the four rules of arithmetic, and on the way to outstripping his master, who was himself rather shaky when it came to the rule of three.

His ambition had now soared so high that he aimed at being a colliery engineer some time in the future. The colliery engineer had a number of engines under his care, which he maintained in good order. Sometimes he planned and built new engines for the pits, if he was ingenious enough. He looked after the iron tramways that ran down to the staithes, and laid out new ones when they were needed. He earned his two pounds a week, and rode a shaggy pony instead of walking to work. He lived in his own cottage, with three or four rooms to himself, and a nice piece of garden. The mining community held no greater object for ambition, and even this seemed far enough away. But George was a very determined young man, and what he wanted he usually managed to get.

Several things happened when he was twenty. He fell in love, for one thing, with a pretty, sweet-tempered girl who was a servant on a neighbouring farm. She was some years older than he, but neither of them minded that. Before he and Fanny could get married, they had to save some money, for even a one-roomed home needs furnishing, so the wedding did not take place at once. About the same time George was promoted brakesman and had charge of the winding gear at the pit mouth. It was intermittent work, especially on night-shift, and there were long, empty hours beside the glowing fire. Sometimes he worked at his slateful of sums, sometimes

at his copy-book. The edges of the paper curled in the heat as his pen travelled slowly over the page in imitation of the schoolmaster's fair, round hand, with its flourished capitals. Sometimes there was a newspaper to be read, a single close-printed sheet that had passed from hand to hand until it was yellowed and torn. In this way he learnt of Napoleon's striding victories across the map of Europe, of Mr. Pitt's speeches in Parliament, of Admiral Nelson's doings with the Fleet (for this was the year 1801).

The slateful of sums was soon finished, and the page of writing filled, and newspapers did not find their way very often to a remote mining village. George could not and would not sit idle beside his fire. He took to mending shoes. First he mended his own, on a last which he had carved for himself. Then he mended the family's. As he grew more expert he charged sixpence a pair, and mended his friends' and neighbours'. Once he mended a pair of Fanny's, and carried them about all day afterwards in his capacious pocket, taking them out from time to time and gazing at them fondly.

There came a day when he had saved a guinea. It was the first time in his life that he had handled a piece of gold of his own.

"I'm a rich man now," he said, and made preparations for his marriage.

When he was offered a job on the other side of Newcastle, there was no reason why Fanny and he should wait any longer. Until now, Newcastle had been the boundary of his world. The family had moved several times as the pits opened and closed, but always under the same masters, and always within a small area on the west side of the town, about three or four miles up the river.

Now George was to move fifteen miles away, to Willington Quay, between Newcastle and the sea. The ships that came up from London had to empty the ballast out of their holds before they could take in their cargo of coal, and at Willington a great hill of chalk and stone and Thames clay had been built up—Ballast Hill, they called it. At the bottom of this

hill was a steam-engine which worked the gear to haul the wagons up to the top, and George was taken on as brakesman to this engine.

He was allotted a room in the row of cottages that stood between the hill and the quay, and this he furnished for himself and his wife, partly out of his savings, and partly out of hers. After living with seven other people for most of his life, a room in which there was only one bed, and enough chairs for both the inhabitants to sit down at once, seemed quite palatial. The crowning glory of the place was an eight-day clock on the wall with a swinging pendulum and a very loud tick.

On November 28th, 1802, they were married. In the vestry of the little church George signed the register slowly and carefully, his tongue going between his teeth all the time. Although he had been learning to write for three years now, it was still difficult work. However, apart from a smear, where his little finger got in the way, he managed very well, and he and Fanny walked out of the church hand in hand, very pleased with the world and each other.

CHAPTER II

YOUNG ROBERT

THE most wonderful baby in the world was born on October 3rd, 1803, and called Robert, after his grandfather. He had dark eyes, and something of his father's look about him—at least, George thought so, and worshipped beside the cradle at every spare moment.

Young Robert was a colliery baby from the start. His christening had to take place in the Wallsend schoolroom, because the church was so rickety that it was not safe. The land on which it was built was so honeycombed with mines that the building had begun to settle, or "creep", as the people called it. All George's brothers and sisters came over for the christening, and drank the baby's health in good strong ale. But although they did not like to say so in front of the proud parents, they thought privately that the baby had not much chance of growing up.

"He's a wee sickly bairn," they said to one another; "not made for long on this earth."

George was immensely proud of the child. Before Robert's first tooth was cut he was full of ideas of teaching him arithmetic, algebra, and mechanics and all the other things he was trying to teach himself. And he determined, as he sat with his son on his knee, that, cost what it might, Robert should have the start in life that he himself had missed.

He worked harder than ever. In the long, light summer evenings there was always work at the quayside for anyone who was willing, heaving the ballast out of the ships' holds so that they would be ready to take in coal in the morning. It was heavy, hard work, enough to break the back of a man who had not got the trick of it, but George, in his usual methodical way, took the trouble to learn the quickest and easiest

method of handling the heavy shovel, and put in hours of overtime. He always had enough energy for three men, and when he was not working was always ready to wrestle with anyone, run a race, or throw the hammer. Once one of his friends bet him that he could not jump from the top of one wall to another, and was horrified when George, without hesitation, climbed up and did the standing jump of eleven feet without turning a hair.

One day, when he was at work and Fanny had gone out with the baby, the chimney caught fire. The neighbours, seeing the thick, black smoke and flying flakes of soot, ran to the rescue with buckets of water from the well, which they poured liberally over the hearth. To make quite sure that all was safe, an enthusiastic passer-by borrowed a ladder and, climbing on to the roof, emptied a couple of buckets straight down the chimney. When George came over from the engine-house he found the place looking like the day of judgment. Everything was full of soot, steam, ashes, and dirty water. However, he and Fanny set to work to tidy up. They mopped up the dirty water and scrubbed the floor. They rubbed the soot off the furniture and polished it. They shook out and aired the damp and dirty bedclothes and curtains. They cleaned the grate, relit the fire, and put the supper on to cook. By the evening there was only one thing they had not been able to set right—the precious clock was clogged with soot and steam and would not go. The neighbours were sympathetic, and advised them to take it to Newcastle.

"Nay, I'll do it myself," said George. "At least, I'll try."

He got out the box of tools with which he had made models from scraps of metal and wood, and as soon as supper was cleared off the table he began to take the clock to pieces. He had never done anything of the kind before, but his hands, so much too big and awkward for a quill, were marvellously neat and precise with anything mechanical. When the clock was put together again it went "as good as new, if not better", and became the talk of all the neighbours.

Every pitman's cottage had a clock. A good clock and a good bed were the two things they spent money on, however pinched they were in other ways. Most villages had an amateur clock-doctor, but there was no one of the kind at Willington Quay. So when George was successful with his own, other crippled clocks were brought to him, and the shillings mounted up in the money-box.

He was never idle for a moment. He still mended shoes, and had taught himself how to make them too. He charged seven-and-sixpence for a pair of pitmen's brogues, and had plenty of customers. He learnt how to carve wooden lasts for the people who preferred to make and mend their own. Then he tried cutting coats and trousers out of the rough grey country tweed and checked flannel that were the usual wear of himself and his neighbours. The men's wives did the sewing, but the cutting out was more than they could manage, and some of them were glad to have the heavier pieces of sewing done for them as well. George, cross-legged beside his engine fire, turned himself into tailor, cobbler, watch-mender—anything that was useful.

Uneducated though he was, he had the stamp of real education on him. He was essentially adaptable, and knew how to see an opportunity and make the most of it. But he was not particularly remarkable in that, for many of the other men were as handy and as hard-working, and there were many years to go before he succeeded in " getting on " farther or faster than they.

When young Robert was two years old George was offered a new job, as brakesman at Killingworth, one of the biggest pits in the Newcastle district. He was not sure at first that he wanted to go. The pay would be better, but there would be no more unloading ballast, and that meant a loss of several shillings a week.

Partly because he did not like to refuse a good offer, and partly because Fanny was not at all well among the damp river-mists, he accepted. Killingworth was a large village, and there would be more customers for his clock-mending and

cobbling. Most important of all, there would be a school handy for Robert when he was old enough.

So they moved to Killingworth in 1806, and settled down in a two-roomed cottage beside the West Moor Pit, where George was to be brakesman. With a loving wife, a fine son, a good job, and a little money saved, George might well feel that at the age of twenty-four he was in very prosperous and enviable circumstances.

The next year everything went wrong. Fanny had another child—a little girl—and both she and the baby died. George was left heartbroken with young Robert on his hands. He did not know what to do. He felt that he could not face life at Killingworth without Fanny, and when a job was offered to him at Montrose in Scotland, he left Robert with his brother's wife and set out northwards, on foot, with his belongings in a bag over his shoulder.

He came back again next year, his grief dulled by time and by his intolerable homesickness for his child and his own people. He had twenty-eight pounds in his pocket, for the pay had been very good, and the Killingworth manager gladly gave him back his old job as brakesman. His sister Eleanor came to the cottage to keep house for him and look after Robert, and the three settled down very comfortably together.

But his troubles were by no means over. His father and mother were in debt and dire poverty. The old man, who had been getting more feeble for some years past, had been blinded in an accident and could not work at all. Half of George's savings went in paying off the debts and moving the old couple to a cottage near Killingworth, where he could look after them. From now on he had to support them as well as himself and Robert. His elder brother James was only a twelve-shilling-a-week workman. The two younger ones were mere boys, hardly able to support themselves. That same year he was drawn for the militia. It was plainly impossible that he should leave his heavy responsibilities and go soldiering, so he had to pay for a substitute. This took not only the rest of his savings, but six pounds that he borrowed as well. All his hard work

for the last eight years had come to nothing but a six-pound debt.

One evening, on the deserted road home from Killingworth, he broke down and cried, as all his troubles came over him at once. He was desperately miserable, and the future, so far as he could see, without any hope. There seemed no chance in England for a working-man, though he were willing to work twenty-four hours a day. Across the sea there was the golden shore of America, where hard work meant prosperity, but it would take him months, or years, to raise the passage money. He could never become an engineer, because he had not served the proper apprenticeship. Life seemed very gloomy indeed.

When he was sixty George told some young working-men, by way of encouraging them: "Well do I remember the beginning of my career as an engineer, and the great perseverance that was required for me to get on. Not having served an apprenticeship I had made up my mind to go to America, considering that no one in England would trust me to act as engineer. However, I was trusted in some small matters, and succeeded in giving satisfaction. Greater trusts were reposed in me, which I also succeeded."

It would have needed a very keen eye to have seen in George's "small matters" any chance of his becoming a famous engineer. He himself was not looking for fame, and coveted nothing higher than a colliery engineer's job. Two pounds a week and a pony would set him up for life.

The first of these small matters was when he rearranged the ropes on the winding-gear at his pithead so that they chafed against each other less, and thus lasted three times as long. It was not an important thing, although it was a useful economy for the mine-owners, new ropes being both expensive and hard to come by in war-time. It was a thing that anyone with a little mechanical knowledge might have done, but the fact remained that it was George who had seen that it needed doing and George who had done it, and the managers were duly grateful.

The second matter was not so small, for here George succeeded where everyone else had failed, including engineers called in from the neighbouring collieries. Near the West Moor a new pit, the High Pit, had been sunk not long before, and an engine had been built to pump the workings clear of water. All during the first year the engine failed to keep the water down, and the miners were " drowned out ", as they said.

Naturally George went to look at the engine. He went to look at every new engine. While it was being built he walked round with a considering air, and then gave it as his opinion that they would have trouble with it before they were finished. It was not for nothing that for years he had spent every second Saturday stripping down a pumping engine, but no one felt inclined to listen to him, and they were merely annoyed when he proved to be right.

When it was quite certain that the engine was defective, George went over to the pit one Saturday when it was not working, and looked at it carefully.

" What do you make of her ? " asked one of the High Pit men who was a friend of his. " Do you think you could do anything ? "

" I could make her draw," said George with certainty. " Man, I could send you to the bottom in a week."

This conversation was reported in high places, and that same evening the colliery viewer came to George and offered to give him the chance to make good his boast. Considering that the pump had been working fruitlessly for twelve months, it was rather a tall order, but George was never one to make idle boasts. He had no doubt that he could do what he said.

He set to work on the Sunday morning with the helpers he had chosen—he would not use the pit's usual engine-men because he knew they were jealous of a mere brakesman being brought in over their heads. The repairs took four days and the pumping out forty-eight hours. On the next Saturday, as he had promised, the men went to the bottom.

The viewer gave him ten pounds, which was a larger sum

of money than he had ever earned in a lump before. But better than the ten pounds was the reputation he began to get as an engine-doctor, and the interest which the owners of the colliery (a group of men whose families had been known as the "Grand Allies" for more than eighty years) took in him. He was called in to prescribe for other engines at other pits, and he was always successful.

It was not just luck and intuition, of course. He had some fifteen years of practical experience, and he never stopped trying to learn and to educate himself a little better. It was hard work. He had long since left the night school, having learnt all that the master could teach, but there was a farmer's son in the village who was something of a mathematician (by pitmen's standards, at any rate), and who was besides a clever, lively, argumentative fellow, fond of reading and of discussing what he had read. George and he became close friends. Among other things, he taught George to draw plans and sections, at which he soon out-stripped his master. Although writing was as difficult to him as ever, plans of engines and machinery meant much more to him than ordinary print.

Somewhere they found a book of "Lectures on Mechanics" —not the newest or most up-to-date of its kind, but a gold-mine to them. They read and treasured every word of this shabby Bible, and every experiment described in its pages they tried for themselves. Whatever apparatus was needed, George managed to make in a rough-and-ready fashion, and they were in such deadly earnest, and hammered their way through that old book with such determination to squeeze the last drop of instruction from its pages, that they knew more than a little about mechanics by the time they had finished.

An interested spectator of these sessions, when they did not take place beyond his bedtime, was Robert. Before he could see over the top of the table he was climbing on to a chair to "help father" with his clocks and his mechanical toys. The very first thing he remembered was sitting on his father's left knee, fenced in by his arm, and watching the careful fingers at work on a clock, or looking from the page he could not under-

stand to his father's furrowed forehead. His chief delight as soon as he was old enough to walk steadily was to carry his father's dinner to the pit at midday and watch the engines at work.

He and George adored one another and were perfectly happy in each other's company. They kept dogs, rabbits, and birds, in particular a very knowing blackbird who had his cage near the door and cocked his head wisely whenever he heard one of them coming. George took the little boy out in the spring to look for birds' nests, as his father had taken him. But they never took the eggs or the nests, as the other lads did.

"Don't take the nests," George would say; "it grieves the old birds. Come and have a peep at them now and then, but don't take them."

In spite of catching colds easily and showing a tendency to coughs in the winter that worried his father and his Aunt Eleanor, Robert grew tall and strong, and was as lively a young spark as ever played tricks on anyone and ran out of reach.

When he was six or seven he started to go to school. It meant walking more than a mile into Long Benton village and back, and kind Aunt Eleanor thought it was too much for her "poor bairn", but George had always meant Robert to go to school, and go to school he should. Robert was not sure that he cared for so much sitting still. Soon after he started school harvest-time came round, and Aunt Eleanor, with some of the other women, went gleaning. Robert begged his father to let him stay away from school and go too, but George was not paying sixpence a week so that Robert could play truant when he felt like it. However, Robert was so insistent that at last George gave in.

"Well, you can go, but you must be out all day," he said. "No skulking and no shirking; mind that. What you begin you must get to the finish of."

Robert found the first day's gleaning hotter and harder than he had expected, but he stuck to it, and came home with his bag full of corn.

"Well, Bobby," said his father, "how did you get on?"

"Very well, Father," said Bobby, swallowing an enormous yawn.

The next day was even hotter and harder, and though Aunt Eleanor let him rest under the hedge for most of the afternoon, it was a very tired small boy who came home, holding her hand.

"Well, Bobby, how did you get on?"

"Middling, father," said Bobby sulkily but honestly, and was asleep before he had had his supper.

But the third day he trailed home with his toes in the dust and to his father's, "Well, Bobby, how did you get on?" he burst into tears and cried, "Worse and worse, Father. Let me go back to school again!"

"There, lad," said George, putting him on his knee, "you'll go back to school and mind your book like a good boy, and leave hard work to grown folk who can manage it."

In 1812, when he was thirty-one and young Robert eight or nine, George was appointed engineer to the Killingworth colliery. He was no longer a humble brakesman. He was not even a working man in the sense that he had been before. He had his two pounds a week, the wage he had always hoped for. He rode a shaggy pony round the various pits, overseeing the engines, prescribing for their ailments when they went wrong, often mending them with his own hands, or telling the colliery blacksmiths how to mend them. And he had his cottage at the West Moor, and his nice piece of garden in which he grew fat onions and enormous cabbages. The cottage was not very large. It originally consisted of one room, with an attic overhead. But he built his own brick oven (he could turn to bricklaying as well as anything else), and built a partition so that the front door no longer opened straight into the living-room, and in time enlarged the cottage until there were four good rooms. He built a desk with shelves above it for his few books and a secret drawer that opened with a spring.

This was not the only curious thing that George invented. The cottage was always littered with tools and models. The garden gate shut with a lock that no one but he could open, and to keep the birds from his currant-bushes he had a scarecrow

(a " fley-craw ", *he* called it) with windmill arms. Then he invented a mechanical cradle-rocker for the pitmen's wives, and a dozen other ingenious trifles.

Soon after he became the official engine-wright he built his first steam-engines—a winding engine for the High Pit, and a pumping-engine for another pit. The coal from Killingworth went down to the staithes at Willington to be loaded, and George altered the tram-road to a self-acting incline. This meant that on the last stretch of road, down to the quay, the wagons full of coal, running downhill, were made to haul up the empty ones on their way back, and saved both time and horse-power as well as accidents. The clumsy horse-drawn wagons were dangerous on a downward slope, for they were provided with only the most primitive wooden brakes, which might burst into flames with the friction of the iron wheels, and one wagon " running amain ", as they called it, could tangle up the wagons and men and horses in front of it in the most horrible fashion.

For jobs like these, which came outside the scope of his colliery engineering, George was paid extra, so that by the time Robert was eleven he was earning about £200 a year, and his savings had reached the sum of 100 guineas—golden guineas, each of them worth twenty-six shillings to the money-lenders.

It was time now to send Robert to a real school, for the village clerk had taught him all he knew, which was not much. Nor was he learning anything worth the name by careering about the country with the idle and mischievous pitmen's boys, robbing orchards and risking his neck after birds' nests. He had already broken his arm by falling out of an elm-tree, and as soon as it was mended properly his father went to see Mr. Bruce who kept a school in Newcastle. There were more than a hundred boys at the " Academy ", as it was called, and at the time it had a better reputation even than the old-established Grammar School of the town. George had never thought of sending Robert to the Grammar School. He wanted the boy to have a sound commercial and mathematical education which would help him to become an engineer. There was to be no nonsense about Latin and Greek and such

gimcracks, although he wanted Robert to learn French because it was useful in business. The boys who went to the Academy were mostly the sons of Newcastle tradesmen, doctors, solicitors, and the like, who for the sum of ten pounds a year learnt reading, writing, arithmetic, algebra, mathematical drawing, and a little elementary science and history.

It was five miles from Killingworth to Newcastle, and on the morning of August 14th, 1815, Robert set out stoutly to walk to school for the first time. Mr. Bruce, the master, knew and liked George Stephenson, and made the boy particularly welcome for his father's sake; but the other boys were not so tactful. Robert's corduroy trousers and blue jacket of his father's tailoring, and his heavy boots, which had seemed so suitable at the Killingworth end of his journey, where many lads of his age were still going about barefooted, were quite out of place in Newcastle streets. None of the other boys brought oatcake and cheese in a satchel. They went home for their dinners, or took them in Mr. Bruce's house. They all spoke with a north-country accent, but they could hardly understand Robert's broad Northumbrian, with its guttural " r's ". They laughed at him at first, and he blushed fiercely under his freckles and turned away, wondering what he had said that was funny, and deciding to keep his mouth shut in future to avoid ridicule.

It did not take more than a day or two, however, for them to find out that he was a cheerful, lively fellow, and Robert, on his side, was quick enough to pick up as much of the accents and manners of his new associates as was convenient. He was no prodigy, but he worked steadily, and did reasonably well. But the ten-mile walk, added to his schoolwork and his homework, which his father never let him scamp, was too much for him. He was too tired to play during the midday break. He seemed to get taller and thinner every day, and coughed at night. His father and his Aunt Eleanor, remembering how poor Fanny had died of consumption, were worried about him. But his father bought him a donkey, on which he could ride to school, and after that things went better. Robert was as proud

as Punch of his "cuddy", and so was the whole village. It was a wise, gentle beast, and when he went over to Long Benton to see his grandfather he could ride it straight into the house and round the kitchen table to where the old blind man, sitting beside the fire, could stroke its nose and pull its ears and exclaim on its beauty and breeding.

His work was not finished when he left school in the afternoon. His father, eager for him to learn, and eager to learn from him, too, drove him almost harder than a twelve-year-old could stand. It was hard, but it was wonderful training, for George expected him to be able to pass on all that he learnt, and there is nothing better for sharpening the understanding. He paid three guineas a year to make Robert a member of the Literary and Philosophical Institute of Newcastle, which had a good library. Sometimes he brought home books for his father to read, but most of the reference books were not to be taken away, and he had to make himself master of whatever subject they were studying, take notes and draw diagrams, and tell his father all about it. And George's quick brain seized so firmly on the salient points of the argument, and asked such extremely searching questions, that Robert had to work very hard indeed to keep his head above water, or else he had to go and spend another golden Saturday afternoon in the library, mastering the subject all over again until he had it to his father's satisfaction. From George he learnt to read diagrams like print, and to draw sections with beautiful precision, although he always used his left hand. When he was older he wondered sometimes if this left-handedness had been developed when he was a baby by the hours and hours he spent sitting on his father's knee. It had always been the same knee he sat on, and only his left hand was free to play with things on the table. By the time he went to school it was too late to change, but it did not prevent him writing and drawing with extreme neatness. At the Academy he won the prize for mathematical drawing.

It was a mixed sort of education, but an excellent one for the life ahead of him. Neither he nor his father doubted for an instant that he was to be an engineer. So much was expected

of him that it might have been an intolerable burden on a different kind of boy, but Robert worshipped his father with every bone in his body, and accepted the burden of gratitude for the expensive start in life that was being given him. All the same, it *was* something of a burden. The neighbours pitied Robert his " over-strict father ", and Robert occasionally pitied himself and went into a state of mild rebellion. He jibbed, for instance, over the sun-dial.

It was the summer of 1816, when he had been just a year at school. His father, as a kind of holiday task, told him to make a sun-dial over the cottage door. Robert, not yet thirteen, said that it was ridiculous. He had not learnt nearly enough mathematics or astronomy. He would not do it.

" The thing's to be done," said George, " so just set about it at once," and when he spoke in that tone of voice there was nothing for Robert to do but set about it.

He went into Newcastle in a very bad humour and borrowed " Ferguson's Astronomy " from the library, and sat down at the desk with it that evening to work out the necessary calculations. Drawing the plan of a dial was not difficult, but it was the question of adapting it to suit the latitude of Killingworth that was the trouble. He started sulkily enough, but the interest of the thing soon gripped him, and his father came over to help. They spent many evenings covering sheets of paper with their calculations, and at last it was done. Then they got a stone, and traced out the copy of the dial upon it, and spent many happy hours carving the figures out with a cold chisel and polishing the rough stone. Quite in love with his labour by this time, Robert added a smiling sun to ornament the whole, and a most elaborate carving of the date—" August 11th, 1816 ".

When at last they got a ladder and hoisted the dial into its place above the door, and plastered it in, they were both immensely proud. What was more, it really did tell the correct time whenever the sun was shining, and the pitmen, passing by to their work, used to set their watches by its pointed shadow.

Nothing pleased George so much as to see Robert sharing

his own tastes, even when he put his mechanical and scientific knowledge to naughty uses. One week-end he made a home-made lightning conductor with a kite and a mile or two of fine copper wire, and chased the cows all round the field, giving them electric shocks. This was all very well, but then he tried the experiment on his father's pony, and nearly knocked it down.

"You mischievous scoundrel, I'll pay you," shouted George, who had not been quite as far away as Robert thought, coming after him with a whip; but Robert was over the wall and down the road, and did not return home until a decent interval had elapsed. George, patting and comforting his frightened pony, had to admit that the boy had a scientific turn of mind.

But before this, before the making of the sun-dial, before Robert ever went to school at Mr. Bruce's, he had already met the great love of his life. When he was nine years old his father took him over to Wylam, where he himself had been born in the cottage beside the tram-road. On that very same road there was a new marvel at work—a black monster of a travelling steam-engine, which needed two men to drive it, one to work the controls at one end, while the other shovelled coal into its glowing furnace at the other. Above its huge iron boiler the pistons worked up and down like a dragon's legs, and the snorting clouds of smoke poured from its chimney as it moved slowly, fearsomely, along the tram-road, drawing a train of loaded wagons.

Robert said nothing, but he held his father's hand very tightly. They were both silent and thoughtful on the way home, for both of them had fallen under the spell of that ugly, impressive, wonderful, and romantic monster—old "Puffing Billy" of Wylam.

CHAPTER III

STEAM CARRIAGES

GEORGE STEPHENSON is so often remembered as "the father of the railways" that he is sometimes supposed to be the first inventor of the locomotive. As a matter of fact, as far as can be ascertained now, his very famous "Rocket" was the forty-fifth steam-carriage to be made in England, and old "Puffing Billy" of Wylam was the twelfth. Stephenson could never have done all that he did had he not had good foundations on which to build.

The stationary steam-engine had been invented a very long time before, and brought to a high pitch of perfection by James Watt in the eighteenth century. All the engineers of the stationary steam-engine (Newcomen, Savery, Smeaton, and Watt) realised that a power which could turn wheels horizontally—for instance, in mill machinery—could also be made to turn wheels in an upright position, wheels which would propel a carriage along a road. A Frenchman, Cugnot, did get as far as building a steam-carriage in the 1760's. It was quite successful—rather too successful, in fact, for on its first trial it went straight through a wall and out the other side, and gave everybody concerned such a fright that they put it into a museum as a dangerous curiosity.

It was not the ideas nor the inventors who were lacking. The chief difficulty in the way of developing a steam-carriage at this time was the state of the roads. Extensive experiments were impossible among the ruts and boulders of the eighteenth-century road.

The mail-coach, bowling along at a gallop, drawn by its team of splendid horses, was not yet a feature of the English scene. This picturesque and uncomfortable method of travelling, which, when the railways came, was lamented by Dickens and a great many other people as an ancient English

institution, was in fact nothing of the kind. It was an innovation not forty years old, that was only made possible by the new roads of Telford, Macadam, and Blind Jack Metcalfe, and as a matter of fact did not reach its peak of perfection until the threatened competition of the railways spurred on the coach-owners.

In 1830 the fast mail-coach between London and Birmingham did the journey in eleven and a half hours, or at the rate of ten miles an hour including stops. But the following advertisement, of 1742, which describes a great improvement on the then existing communications, shows clearly enough what the roads must have been like in the eighteenth century, and how impossible it was for anyone to think of building steam-engines:

> "The Litchfield and Birmingham stage coach set out this morning (Monday) from the Rose Inn, Holborn Bridge, London; and will be at the Angel, and the Hen and Chickens in the High Town, Birmingham, on Wednesday next to Dinner, and goes the same afternoon to Litchfield; it returns to Birmingham on Thursday morning to Breakfast, and gets to London on Saturday night, and so will continue every week regularly with a good coach and able horses."

It was in 1784 that a model steam-carriage, on three wheels, was made by a most ingenious Cornishman, William Murdock. This little machine stood a foot high and was worked by a spirit-lamp. Murdock was an employee of Boulton and Watt, the steam-engine makers. He lived for some years in Cornwall, looking after all the engines that the factory had supplied to the tin-mines.

> "I wish [wrote James Watt to his partner rather peevishly] that W. could be brought to do as we do, to mind the business in hand and let others throw away their time and money hunting shadows."

It was, however, none of his business what Murdock did with his spare time, and the ingenious workman made at least three "very pretty working models", one of which went round the

room at a great rate, carrying all the fire-irons. It could run as fast as a man, and on one occasion at least outstripped its maker.

> "One night, after returning from his duties in the mine at Redruth, in Cornwall, Murdock determined to try the working of his model locomotive. For this purpose, he had recourse to the walk leading to the church, about a mile from the town. The walk was rather narrow, and was bounded on either side by high hedges. It was a dark night, and Murdock set out alone to try his experiment. Having lit his lamp, the water shortly began to boil, and off started the engine with the inventor after it. He soon heard distant shouts of despair. It was too dark to perceive objects; but he shortly found on following up the machine, that the cries for assistance proceeded from the worthy pastor of the parish who, going towards the town on business, was met on the lonely road by the hissing and fiery little monster, which he subsequently declared he had taken to be the Evil One."

Boulton and Watt gave him no encouragement, and Murdock was not ambitious enough to pursue his experiments any farther. It was left to one of his apprentices, a very clever but somewhat hare-brained engineer called Richard Trevithick, to take up the work where he left off.

Trevithick was ten years older than George Stephenson, with much the same background but with the advantage of some education. He undoubtedly made the first real locomotive, as early as 1801. It failed because of the dreadful state of the roads, and the "Puffing Devil" or "Captain Dick's Puffer" (a "captain" is a supervisor in a Cornish mine) broke down after a very short life. The second was built for a Welsh colliery, and was much more successful, as it had the smooth surface of the tramway to run on. But the brittle cast-iron rails, strong enough for the wagons, were not strong enough for the engine, and after a few trials, during which it acquitted itself very well, dragging twenty-five tons of iron, it broke up the road so much that it had to be abandoned.

The third engine was even better. In 1808 Trevithick and

his cousin Andrew Vivian (who financed the partnership) decided to take it up to London to show it, for a remote corner of Cornwall is not the best breeding-ground for inventions. They took it as far as Plymouth by road, and thence shipped it to the Thames.

As they were careering merrily along the Plymouth road, Vivian, who sat in front steering the thing, like a coachman with a team of invisible horses, saw a closed toll-gate ahead. They shut off steam, rolled up to the gate, and stopped with an inch to spare. The toll-keeper whisked open the gates in a great hurry.

"What have us got to pay here?" said Vivian from his perch, with his hand in his pocket.

The gate-keeper stammered, but was in such a fright that he could not get a word out.

"What have us got to pay here, I say?" said Vivian impatiently.

"Nothing to pay! N-nothing to pay!" cried the toll-keeper, cringing before this strange and snorting monster. "My dear Mr. Devil, do please drive on as fast as you can! Nothing to pay!"

When it reached London, the engine was billed as a "Circular Railway" or "Steam Circus", and shown in an enclosed field near what is now Euston station. A ride on "Catch-me-who-can" cost only a shilling, but, curiously enough, the engine aroused little interest, and failed to pay its way.

Trevithick, for all his brilliance, was an impetuous man who lacked George Stephenson's gift of perseverance. He gave up his locomotive experiments, leaving the field clear for others to follow him and profit by his work.

In spite of the apathy shown towards "Catch-me-who-can", steam was really beginning to stir the public imagination. As early as 1789 a poet wrote:

> "Soon shall thy arm, UNCONQUER'D STEAM, afar
> Drag the slow barge, or drive the rapid car;
> Or on wide-waving wings expanded bear
> The flying-chariot through the fields of air."

The next step in locomotive history was taken in the north-country collieries. Owing to the ever-increasing demand for coal, the colliery owners were eager to find any device that would speed up transport of this bulky and awkward commodity. The war made the matter more urgent, for the price of corn was rising steeply. An engine which would do the work of ten horses and at the same time eat coal instead of corn would be a godsend.

A Mr. Blenkinsop of the Middleton Colliery near Leeds built two engines after Trevithick's pattern in 1811. The four main wheels which supported the engine were not steam driven. The impetus came from a fifth wheel, a large cog-wheel working on a special toothed rail laid down beside the ordinary track. At that time it was widely thought that smooth wheels would not bite on smooth rails if there were any weight behind the engine, and many ingenious devices were invented, then and for a long time afterwards, to overcome this imaginary difficulty. (The " Mechanical Traveller ", which blew up on its first trial in Derbyshire, killing several people, had two legs behind its wheels, walking along alternately !)

Blenkinsop's two engines began work in 1812, the year George Stephenson became engine-wright at Killingworth and had time and opportunity to gratify his interest in locomotives. He could not go all the way to Leeds to see them, but the following year one on the same pattern was in use not far from Newcastle, and he paid it more than one visit. He knew the builder of it, who had been one of Trevithick's workmen. He and George, and many other engine-wrights and engineers from the collieries, used to meet on pay-nights in a Newcastle inn and discuss the subjects that interested all of them, of which the one that cropped up most often was steam locomotion.

This Blenkinsop locomotive, the first that George saw, interested but did not impress him very much. He was heard to say that he could make a better one himself.

" Puffing Billy ", which he took young Robert to see the next year, was not a Blenkinsop model. It was made by a Mr. Blackett, owner of Wylam colliery, or rather by his engine-

wright under his direction, for he was not a mechanic himself, although he had the influence, the money, and the ideas that were necessary. He was fortunate, too, in having two extremely practical and ingenious men to help him—his engine-wright and his viewer. The three of them made up just the sort of team that was needed.

In George's young days, when he used to herd the cows beside the Wylam tram-road, the rails were only of wood, and along them the slow trains of horses passed twice a day with their chaldrons of coal. Mr. Blackett had changed the wooden rails for iron ones, on which each horse could pull twice or three times the weight. There were two sorts of rails in use for tram-roads, and the problem of improving them was almost as urgent as the problem of improving the haulage. *Plate-rails*, such as were laid at Wylam, were flat rails with a raised flange on the inside. The wagons which ran on them could run equally well on the public road, for they had no flange, and ran on the flat part of the rail, the raised part preventing the wheels from slipping. *Edge-rails*, such as were laid on the rail-road at Killingworth, were smooth, raised rails, usually with a slightly curved top, very much like modern railway rails, but much smaller and slighter. The wagon-wheels were made with a flange on the inside, or sometimes with a flange on either side, to make them grip.

Mr. Blackett did all that he could to improve the Wylam railroad before he turned his attention to locomotives. He was a forward-looking man, interested in anything which would improve the coal-traffic, and when he heard about Trevithick's engines (about 1810) he ordered one from the inventor. It was not successful and never ran, but he set about procuring another. Instead of having it shipped from Cornwall, he took the easier course of having it made to Trevithick's pattern in Gateshead. It was a curious machine, with an immense fly-wheel at one side which made it look very lop-sided, and a cylinder which worked away out in front of the boiler, rather like a man playing a trombone. Even the engine-wright who helped to build it said that it was " a strange machine with lots

of pumps, cog-wheels and plugs, which needed constant attention when in motion ".

This six-ton contraption, when she was at last got upon the road, would not move an inch.

" Either *she*'ll go or *I*'ll go," said the engineer, grimly, with his hand on the safety-valve.

" She flew all to pieces then," said a bystander, " and it was the biggest wonder in the world that we were not all blown up."

So ended the second Wylam engine, which was patched up and used as a stationary engine, but never worked as a locomotive.

Mr. Blackett was a determined man, and in spite of two failures and a good deal of opposition, he had the third engine built in his own workshops at Wylam. This one did at least go, and took eight loaded wagons with it, but it was extremely and painfully slow. Its best speed was about a mile an hour, and it frequently took six hours over the five-mile journey. It was too heavy for the cast-iron road, the plates of which were constantly snapping under its jolting progress, and it broke down so often that after a while the horses used to follow it as a matter of course to take over when it failed or when it slipped off the rails, which it did with embarrassing frequency.

(" How do we get on ? " said the driver cheerfully in answer to an inquiry. " We don't get on. We only get off.")

Still Mr. Blackett was undeterred, and embarked on a fourth engine. This was " Puffing Billy ", of some fame.

" Puffing Billy " was a huge black monster. Its pistons worked above the boiler in a maze of rods and cranks, and its underparts consisted of a wonderful collection of cogged wheels working into each other. It was not speedy, but then speed was not the object. A greater rate than three or four miles an hour would have upset the horse-traffic which also used the road. The main use of a locomotive was to do the work of as many horses as possible, and Mr. Blackett was aiming only at an efficient, strong, sturdy, reliable machine, able to drag thirty tons or so. Unfortunately, he had not got it in " Puffing Billy ". The thumping and grinding as it laboured along

wore the best rails to pieces, and it broke down rather more often than not. However, on its good days " Puffing Billy " was an impressive sight, and George Stephenson was duly impressed.

He was a man who could not bear inefficiency. He hated waste more than anything, and wasted energy most of all. When he was unloading ballast at the Quay he took the trouble to learn the best way to handle a shovel. When he saw the ropes of the winding-gear chafing together, he at once began

Puffing Billy

to think how to rearrange them. When he saw the coal-trucks running downhill, he worked out a method of using their weight to haul up the empty wagons.

This made him the most efficient engine-wright that Killingworth had ever had, and the owners, particularly Lord Ravensworth, chief of the " Grand Allies " at that date, looked very kindly on him. He made all sorts of improvements, both above and below ground, for lessening waste and making the pits more efficient. He would have been interested in the possibilities of steam-carriages even if, as had actually happened, he had not also fallen in love with steam locomotion. On the day that he saw " Puffing Billy " he found his vocation.

" The first locomotive that I made," he said a very long time afterwards, " was at Killingworth Colliery, and with Lord Ravensworth's money. Yes, Lord Ravensworth and partners were the first to entrust me with money to make a locomotive engine. That engine was made thirty-two years ago, and we called it ' My Lord '. I said to my friends, there was no limit to the speed of such an engine, if the works could be made to stand it."

So at least one man had realised the possibilities inherent in his jolting, grinding, puffing, snorting old rattle-trap. It was an improvement on " Puffing Billy " and all the previous engines, but it was a clumsy contraption enough, made in a colliery workshop by colliery blacksmiths. The wheels and rails were both smooth, for Stephenson never subscribed to the popular belief about want of adhesion between wheel and rail. Its two cylinders were set upright in the boiler, and a confused Chinese puzzle of rods and joints transmitted the power to the wheels. The pistons worked the cross-heads, the cross-heads worked the connecting-rods, the connecting-rods worked a series of cogged wheels under the boiler, and the cogged wheels worked the driving-wheels that carried the train. It could draw thirty tons weight at four miles an hour, and was to that extent an improved model, but it was not very beautiful or efficient. Among other disadvantages the waste steam escaped from under the boiler in screaming gasps, enveloping engine and engineer in a dense fog from time to time, and frightening cattle and horses to such an extent that a local landowner threatened legal action.

This engine took nearly a year to build—a year often interrupted by alterations and improvements, strippings down and buildings up again—and began work on the Killingworth Railway in 1814. Its usual driver was George's brother James.

There is a legend that one of the mechanics said to George, as they watched the engine at work: " Could we not let the waste steam off through the chimney? It would be quieter, and, besides, it would look so much better."

This suggestion, it is said, gave George an idea which was

to have far-reaching effects. He experimented on his second engine, which was already taking shape in the workshop.

One of the chief problems in the early engines was to make the fire burn hotly enough to get up a large amount of steam and keep it at pressure. Stephenson saw, after revolving the matter in his head for some time, that the waste steam was the answer. He conducted this steam from the pistons through a pipe and let it escape vertically up the chimney from the bottom. The pipe through which it escaped into the chimney was narrowed at the entrance, which, like the narrowed end of a hose-pipe, increased the force of the jet. This jet of steam, hissing up the chimney, enormously increased the draught, and the fire burnt much more brightly—so brightly that the chimney not infrequently glowed red hot; but that was a fault in the right direction. The really brilliant thing about the steam-blast was its economy. The brighter the fire burned, the more steam was raised; the more steam was raised, the more rapid the blast and the brighter the fire burned.

The steam-blast, however, could not be fully effective in an engine with as little power as the one George first built at Killingworth, and it is probable that for some years he did not really realise the implications of what he had done. Nor was he the first person to discover the use of the blast. Trevithick, writing about his second engine as far back as 1804 said, " The steam is delivered into the chimney above the damper . . . it makes the draught much stronger by going up the chimney ". He also made the discovery, and he, like Stephenson, did not realise how important it was, because afterwards he patented some special and peculiar bellows to increase the draught. Other engineers too, independently and generally by accident, made the same discovery. In fact, the history of the steam-blast is more than usually confused, but it was definitely used in Stephenson's second engine, and probably in every succeeding one, although its full usefulness was not realised until the building of " Rocket ", some fourteen years later.

The second engine was finished and ready for work in 1815.

Waterloo had just been fought, and it was christened "Blücher"—which the men pronounced "Blutcher"—after one of the allied generals. "Blutcher" was a great improvement on "My Lord", although the first engine went on working for many years. The tangle of cog-wheels under the engine had been done away with, and the whole working was very much simplified, although it still had a resemblance to a prehistoric grasshopper.

The conception of this engine was a remarkable piece of

"Blutcher"

work for anyone, particularly for a young, half-educated colliery engineer, but the making of it left much to be desired. The lack of skill shown by his mechanics often exasperated Stephenson. He knew exactly—only too exactly—what he wanted, but a colliery smithy could not provide the tools or the men. For instance, when he was building "Blutcher", he wanted to have cranked axles forged so that they could be made to communicate with each other by rods, and the movement of all four wheels synchronised (the cog-wheels had done this, but he wanted a simpler device). The trouble was, that it was impossible to find a mechanic who could forge a cranked axle. The thing had never been done before. In the end

" Blutcher's " wheels were joined by an endless chain between the two axles, which was far from satisfactory, as it was apt to stretch, and gave a great deal of trouble.

In spite of these difficulties, " Blutcher " was fairly efficient, and much admired. People came from many parts of the country to see it, as it was undoubtedly the best of its kind. But it was very far from the engine that Stephenson saw in his dreams.

CHAPTER IV

THE SAFETY LAMP

When young Robert went to Mr. Bruce's Academy, in spite of his rough clothes, his curious accent, and his colliery background, he did not feel socially inferior to the other boys. Their fathers might serve behind counters or sit on office stools, but his father was making quite a name for himself round Newcastle. That autumn saw "Blutcher" at work on Killingworth railway, and it also saw the affair of the safety lamp. Not everybody outside the colliery business knew about the first, but the whole of Newcastle rang with the other.

Safety lamps had been topical for some years past. Work in the mines was hard, and it was also dangerous. The highly inflammable gas called "fire-damp" escaped from the coal. The smell of it was everywhere in the pits, and in some of the galleries it could be heard hissing out of cracks in the coal-face (called "blowers") with a noise like a boiling kettle. A lighted candle might at any moment touch off a pocket of this gas and turn a whole mine into a blazing inferno.

At Brandling's mine near Gateshead in the year 1812 there was a terrible explosion, in which ninety men and boys lost their lives—a whole village bereft of its men in one hour. At the same mine a year later another explosion killed twenty-two people.

In spite of such warnings, the miners were fatalistic in their attitude to danger so long as it did not actually touch them, and carried their naked lights about the pits with contemptuous carelessness.

"It's never happened yet," was their attitude, and when it did happen there was generally no second chance for them to be more careful.

The best of the mine-owners were seriously worried, and did

all that was humanly possible to make the mines safer. Quite apart from the danger to their men, it was in their own interest to do so, for mining was a very wasteful business in those circumstances. Two-thirds of the coal had to be left in the seams, and often the most fruitful " drifts " had to be walled up and abandoned owing to the danger of escaping gas. Every device of ventilation was tried, but nothing was really successful. What was needed was a light without a flame, and yet flame was the only sort of light that anybody knew, and a flame could not be entirely enclosed and still keep alight.

Some ingenious person invented a sparking wheel, a larger version of those flint-and-steel toys one sometimes sees, which, when rotated rapidly, gave out a shower of sparks. The glimmer of light from this contraption was so very faint and feeble that few pitmen could be persuaded to use it. Besides, the sparking wheel needed a boy to work it, which made it doubly unsatisfactory. Another suggestion was to use the phosphorescence from decayed fish-skin, but that never came to anything much. A safe and practicable invention was a lamp to which the air supply was pumped through water, but it was too unwieldy for common use.

So candles continued to be used, and accidents were alarmingly frequent. They were, in fact, on the increase, for with the constantly increasing demand for coal, and the many improvements in pumping-engines and other pit tackle, the coal-seams were being excavated more deeply and thoroughly. Between 1800 and 1815 more than 500 miners lost their lives in Northumberland and Durham, most of them by explosions of fire-damp.

Soon after George Stephenson went to Killingworth there was one such accident down his pit. Owing to the time of day, there were not many men underground when the explosion occurred, but even so twelve lives were lost and £20,000 worth of damage was done.

Killingworth was a very large mine, with 180 miles of galleries. As at most other mines, it was the practice for the pitmen to go down very early in the morning, sometimes soon

after midnight, and come up " to grass ", as they called it, in the afternoon, so that most of their leisure hours were spent in the daylight.

Morning was the time for hauling up the corves full of coal, and the brakesmen were hard at work until midday. After the coal came the miners, and then the afternoon was a slack time.

On this particular afternoon the coal and the men had all come up, and there were only four men left down George Stephenson's pit, engaged on a building job. An overseer, wishing to see how they were getting on, told the brakesman to send him down. He had reached the bottom and begun to walk along the gallery when he heard an ominous and increasing rumble ahead of him. He hastily threw himself down in the partial shelter of some pillars, and the explosion went over his head like the crack of doom, leaving him unhurt but half-stunned, and with most of the clothes torn from his back.

Stephenson, fortunately for him, was about fifty yards from the mouth of the pit when he heard the explosion. He turned to look back, and remembered the moment for the rest of his life. The pit had become a gun pointing straight at the sky, and from the mouth stones, wood, broken corves, ropes, tackle —everything that had been at the bottom in the path of the blast—flew up into the air like grapeshot and fell again like hail. For a quarter of an hour the roaring discharge continued.

George went as near as he dared. The ground round the pit-mouth was rocking like water. The winding gear was blown to pieces. The huge pumps had been twisted into grotesque shapes and lifted bodily out of the ground.

He was among the first to hurry towards the next pit, where they found the winding-gear unharmed. This pit was connected with the other by strong doors in one of the drifts. If the doors had held fast, people might be alive below. There must have been men in the more distant parts of the mine who would scramble for the pit and safety as soon as they heard the explosion. The ropes were let down, held for a few minutes, and wound in again. This was done several times, and several

men were brought up. They were more or less dazed, but unhurt. They could tell nothing of the unfortunate workmen who had been down the first pit. No one expected them to be alive, and indeed their bodies were rescued months afterwards, when the piles of rubbish were cleared out of the shaft.

The overseer, however, escaped. Stunned and deafened, he had waited until the explosion was over, and then made his way through the doors into the second pit. His adventures were not yet finished, for when he was half-way up the shaft on the end of a rope a second explosion, this time short and sharp like a single gunshot, blew him up the shaft, rope and all, and landed him safely on the platform at the top.

The gas underground continued to explode at intervals for several days, as fresh pockets of it drifted into contact with the burning coal. Work at the mine was held up for months, first while the fire was drowned by water, poured into it from every beck, brook, ditch, and pond in the neighbourhood, and then while this sea of water was all pumped out again.

Some time afterwards twelve more men lost their lives in the same pit. A year or two after that again, George Stephenson, who was now the engine-wright, was disturbed one day by a man bursting in at the door of his cottage.

" T'pit's afire ! "

The terrible news had already spread through the village, and a stream of people poured from every house and up the road towards the mine. Some cried as they ran, but most were grey and silent. It was during a working-shift, and all the miners were down the pit. The brakesmen were working furiously to bring up as many of them as possible before the pit exploded. There were dozens of men below. Only a few could come up at a time, and the cries and shouts of the others as they struggled for the corves in furious panic were horrible to hear.

Stephenson pushed roughly through the crowd, reached the pit-head and jumped into the corf.

" Send me down," he said to the brakesman.

As he neared the bottom the panic-stricken men were silenced

for a moment by the sight of someone coming down the shaft into danger.

"Stand back!" he shouted, and his voice went echoing along the galleries in the sudden silence. "Are there six of you with courage enough to follow me? If there are, we'll have that fire out yet."

Courage being as contagious as fear, in a moment he had as many volunteers as he wanted. They were as eager to go into the danger now as they had been to escape from it. Building materials were always at hand in every pit, and when George had found out exactly where the fire was situated, he led the way along the black, reeking passages towards it, intending to build a wall at a narrow place and so seal off the fire and smother it. It was rather like walking down the barrel of a gun towards the bullet, but the men trusted George, and George always had an immense trust in God and himself. The fire was put out and worse disaster averted, although several men were killed by suffocation.

A few days later, when the mine was quite safe again, Stephenson went down with the others on the melancholy search for the dead pitmen. He stood aside in a narrow gallery to let two men go past with a body on an improvised stretcher.

"Can nothing be done to prevent this sort of thing?" a man beside him said.

"I believe I know a way in which something might be done," answered George, who had been thinking of nothing else day and night.

"Then the sooner you start the better, for the price of mining nowadays is pitmen's lives."

George did start straight away. In fact, he had been making experiments for years past, from time to time, trying to find some way in which a light might be made to burn without exploding the gas, but it was not an easy problem for a man to solve who had no knowledge of chemistry. However, it was George's greatest gift to believe implicitly in the power of perseverance, and after this latest accident he turned to his experiments with fresh resolve. There *must* be an answer.

It was characteristic that he found the answer in the end, although he worked on perfectly wrong principles. The answer was, as every schoolchild knows who has held a piece of wire gauze over the flame of a bunsen burner, that flame will not pass through as small an aperture as air. Therefore a lamp to which the air was led by very small tubes, and from which the exhausted air escaped by similar tubes, would burn perfectly safely in the most inflammable surroundings. The inflammable air could get *in* and burn inside, but once burning it could not get *out* to ignite the gas outside and cause an explosion.

This discovery was not made all at once, and when it was made it was made for the wrong reasons. But that did not matter, and does not detract from the merit of the discovery. For months George spent his spare time in experiments. Nicholas Wood, head-viewer of the colliery, a friend and fellow-enthusiast for steam-engines, helped him. Night after night the two of them sat at the table in Stephenson's kitchen, thrashing over and over their problem, drawing out 'plans, scribbling them over in hasty impatience and drawing out new ones, snatching the paper from one another as fresh points struck them, while Robert left his homework to lean his elbows on the table and watch.

There were other evenings when George went off to the mine alone, with a supply of candles, and messed about in galleries full of gas. The pitmen complained. They did not care, they said, to come round a corner suddenly and find Stephenson setting light to blowers of gas.

"I'm busy with a plan for saving men's lives," was all George would say when they remonstrated, so they left him alone to his queer games, and took care to walk another way round.

It was in October 1815—the first autumn of peace after Waterloo, and two months after Robert had gone to school—that George walked into Newcastle one afternoon to fetch his safety lamp from the tinsmith who had made it to his pattern. It was getting dark that evening when Moodie, the under-

viewer, poked his head round the door of the cottage. The place was empty except for Robert, who was reading by the fire.

"Has your father got back with the lamp yet?"

"No."

"Then I'll just wait until he comes. He can't be long."

Half an hour later Stephenson came in with the precious lamp in a brown-paper parcel under his arm. His face was shining with excitement. They unwrapped the lamp and set it down reverently on the table. It was about ten inches high, a narrow tube of glass with a metal top full of tiny holes like a sugar-caster. They filled it, trimmed it, and lighted it, and the small flame burnt up bright and clear. George could not wait. He meant to test it then and there.

"Run over to Benton for Nichol, Robert," he said, "and ask him to come directly. Say we're going down the pit to test the lamp."

Although Robert had had his twelfth birthday the week before, he was not very fond of the long, dark road to Long Benton village after dark. He would not have said so for the world, however, and trotted off immediately. He intended to go by the short cut through the churchyard, but when he reached the gate and peered through, he saw something ghostly white moving about among the tombstones. His heart thumping wildly, he took the long way round by the high road, and although a second look over the wall showed nothing more spectral than the sexton at work on a late job by candle-light, he had not quite recovered from his fright until he reached Nicholas Wood's house.

He rather hoped that Mr. Wood would walk up to the West Moor and keep him company, but as soon as he had delivered his message the viewer saddled his pony and trotted away, leaving Robert well behind. He did not reach home until they had gone, and as it was past eleven, Aunt Eleanor said that he was not to sit up for his father, and sent him to bed.

Meanwhile the three men down the mine had chosen a gallery where the gas was hissing out of the roof, and had

put up some boards to shelter the place and make the air even thicker. This done, they went off to a clearer place to wait.

After an hour Moodie, who knew most about fire-damp, went off in the dark to reconnoitre. He sniffed the thick air, coughed, and came back again. A lighted candle in that place would make a nice explosion, he said.

Testing the Safety-lamp

This was just what George wanted, and he lighted his lamp. The other two were doubtful. It was not that there was enough gas to make a really dangerous explosion, but if the lamp did not work they might all be badly burnt. Would it not be better to try the lamp first somewhere else? George refused. In that case, they said, he could go alone. He shrugged his shoulders and marched off unconcernedly, while the other two watched the reflection of his small light fade into the darkness of the mine. No explosion was heard, and in a few minutes they heard him coming back again in the darkness.

The lamp, held up close to the mouth of the blower, had blazed up and then gone out. He had come back to re-light it.

He took it back a second time, and the same thing happened. The third time Wood and Moodie watched from a discreet distance. The fourth time they came with him. The fifth and sixth times they tried it for themselves. Each time the explosive air found its way into the lamp, blazed up, but did not escape. The lamp was proved safe enough, although it could hardly be called satisfactory owing to its habit of smothering out.

George thought he saw how to improve it, and the next few weeks were spent in experiments in which, to his intense pride, Robert was allowed to help. Once they nearly took the roof off the cottage, and once—worse calamity—they blew up a large retort which had been borrowed from the Philosophical Society at Newcastle. After the crash they looked at one another in horror, and wondered how they would dare to confess the breakage.

Not far across the fields from the Stephensons' cottage was Gosforth Hall, the home of that Mr. Brandling in whose mine the dreadful accident of 1812 had occurred. He was very interested in George and George's experiments, and used often to walk across the fields to see how they were getting on.

The second lamp was ready and tried out early in November, and the third and final model was ready by the end of the month. It was shown to the managers of the mine, and then demonstrated before the Philosophical Society, who no doubt thought that their retort had been sacrificed in a good cause. George had never tried to speak in public before, so he took Nicholas Wood with him to do the talking, but when he had to answer one or two questions he did not acquit himself at all badly, and in fact the gentlemen of the Society were very impressed by the serious honesty of this young colliery man.

The lamp was of course christened "the Geordie", and the managers of the mine immediately ordered enough to equip all their pitmen. While the lamps were being made, the urgent need for them was underlined by the death of a boy

who was killed at that very blower where Stephenson had made his first experiments.

Discoveries are rarely made by one man at a time. The history of inventions is full of curious coincidences, and often of disputes and recriminations between the parties, who accuse one another of stealing their ideas.

Davy's Lamp

Cover

Lamp

Stephenson's Lamp

While Stephenson was experimenting with his lamp, a much more famous person was considering the same matter. This was Sir Humphry Davy, the brightest scientific star of the age, a young man no older than George, but who had already been knighted for his brilliant scientific work. Davy had been asked to invent a safety lamp, if he could, for the poor Northumbrian pitmen, and at the end of that same October he had written to

a friend in the north describing his progress. At the beginning of November he displayed his lamp before the Royal Society in London, and read a paper " On the Fire-damp of Coal-mines and on Methods of Lighting the Mine so as to Prevent its Explosion ". The lamp he made was much like Stephenson's, but it had one beautiful simplification. Davy, like Stephenson, had begun his experiments with fine tubes, but had then shortened the tubes to nothing at all and simply surrounded his lamp with wire gauze.

The relevant dates concerning the two lamps are:

1. October 21. Stephenson's *first* lamp tried out.
2. October 31. Davy's letter describing his experiments.
3. November 4. Stephenson's *second* lamp tried out.
4. November 9. Davy's paper before the Royal Society.
5. November 30. Stephenson's *third* lamp tried out.
6. December 6. Stephenson's lamp displayed in Newcastle.

Looking at these dates, it is obvious that the two men were working independently. Neither of them could possibly have stolen the other's ideas. At the time however, except to Stephenson's immediate friends who had seen him at work on the first and second lamps, the list of dates appeared to consist only of 2, 4, and 6 (2 because Davy's letter had been read aloud at a miners' meeting at Newcastle). As everyone knew about the brilliant Sir Humphry Davy, but no one knew about the obscure Northumbrian engineer, and as moreover the two lamps were almost identical, it did look as though Stephenson had plagiarised and then tried to steal the thunder. (There were also one or two valiant supporters of George who insisted that it was Davy who had stolen the idea.) Davy himself was very bitter about his rival—" that spurious Aladdin ", he called him.

A meeting of coal-owners was called in Newcastle to vote a testimonial in gratitude to Sir Humphry Davy. Mr. Lambton, the greatest mine-owner in the north (they called him " King Jog " because he had once remarked that " a man could always jog along on £70,000 a year "), was in the chair. Mr. Brand-

ling stood up to put forward Stephenson's claim [illegible] invention of the safety lamp, but the meeting would n[illegible] to him, and he walked out in protest. £2,000 was colle[illegible] as a testimonial to Davy, and 100 guineas voted to th[illegible] insignificant engineer " in consideration of what he had done in the same direction ".

In the circumstances, this was an insult, and Mr. Brandling told George that he would have to write down his own defence and send it to the papers. This was not at all in George's line of country. Speaking in public, as he had had to do before the Newcastle Philosophical Society, had been ordeal enough. A written composition was even worse. He had never been able to make head or tail of the rules of grammar and punctuation, and his spelling was more original than orthodox. Still, he was not one to shirk something that he thought he ought to do. That evening he set Robert down at the table with pen, ink, and a large sheet of foolscap, and stood over him:

" Put down there just what I tell you," he said.

It was not a very long statement, but it took several evenings of hard work before it was done to both their satisfactions. Then, on a clean sheet of paper with a newly trimmed quill, Robert made a fair copy in his best copperplate writing with very curly capital letters.

When it was ready they set out for Gosforth Hall (George was in his working clothes, but Aunt Eleanor called Robert back to put on his Sunday jacket) to see Mr. Brandling. He read the letter through, raised his eyebrows, smothered a smile, and shook his head.

" This will never do, George."

" It's all true, sir," asserted George stoutly.

" That may be, but it is badly written."

Robert turned scarlet with shame, but Mr. Brandling, seeing his mortification, kindly explained that he was criticising the style and not the handwriting. He offered to revise it, and sat down at his desk then and there.

The result, polished out of all resemblance to George's natural blunt turn of speech, but proving very clearly the

of his having copied Davy's ideas, was published erwards in the local paper and in the *Philosophical gazine*. It started a newspaper controversy which raged for months between the adherents of the two parties, but after his one literary effort George was content with whatever reputation he had gained, and attempted no more letters to the papers. Sir Humphry Davy was never convinced of Stephenson's honesty, and unfortunately died before the day of his fame. If he had lived to see "Rocket" or the Liverpool and Manchester Railway he might have realised that his rival was a man of genius like himself and no impostor.

Mr. Brandling took the chair at another meeting of coal-owners, and this time £1,000 was subscribed as a reward to George Stephenson "for the construction of a safety lamp calculated for the preservation of human life in situations formerly of the greatest danger". Part of the money was used to buy a silver tankard, suitably inscribed, and the miners themselves clubbed together to buy a handsome watch and chain.

These gifts were presented at a dinner in the Assembly Rooms at Newcastle, and George had to make a speech of thanks. With enormous difficulty he had composed this speech, written it out, and learnt it by heart. On paper it looked rather good. It began:

> "Sir,—In Receiving this valuable present which you and the Gentlemen of this Meeting has bean pleas'd to present me with this day I except with Gratitude But permit me to say valuable as this present is and gratefull as I feal for it I still feal more by being honour'd by such and highley respectable meeting the Gentlemen of which having not only rewarded me beyond any hopes of mine for my endeavours in construting a safity Lamp but has supported me in my claims as to priority in my invention to that of that distinguished Pholosipher S H Davy."

He was not quite sure about "Pholosipher", and tried it out several different ways on a spare piece of paper. As they all looked equally odd he left it alone.

But on paper was one thing, and standing up in front of a room full of gentlemen was quite another. He blushed at the first word, and remained scarlet until he sat down again.

"If you could but have seen me meeting so many gentlemen at the Assembly Rooms, you might have lit a candle at my face," he said when he was describing the occasion afterwards.

But if he felt that he had come off rather badly, the gentlemen thought otherwise. There was something very charming about his smile, and something very honest and forthright about his hesitating sentences. When he sat down, relieved that it was all over, there was genuine and enthusiastic applause. He brought the silver tankard home, and set it proudly in the exact middle of the dresser. Next Sunday all his relations came to admire it—not only brothers and sisters, but aunts and cousins from far and near.

"Now you'll be having ruffles on your shirt," said one of them, "and then you'll be looking down on your old friends."

He shook his head.

"Nay, you'll never see no change in me."

CHAPTER V

THE STOCKTON AND DARLINGTON RAILWAY

BETWEEN the safety-lamp, and the Killingworth railway, and his doctoring of sick engines, George Stephenson began to make quite a name for himself within the confines of his own neighbourhood. But, all the same, the year 1819 saw him in a mood of deep depression, not for the first time in his life. He was now nearing forty, and for the last thirty years he had made every effort in his power to "get on", with how little result. It looked as though he would never rise higher than a colliery engine-wright, and that all his dreams of civil engineering and of making the locomotive steam-engine a power in the land would come to nothing. His son was at a good school, and that was something. He had a tidy little bit of money put by, and that was something. But it was not enough. He had neither the money, nor the influence, nor the education, to back the ideas which swarmed in his head, and it looked as though he would stick for the rest of his life in an uncomfortable half-way position, dissatisfied with what lay behind him, and not able to reach what lay in front. He had gone as far as he could alone, and now he was kept waiting until men without half his brains or his foresight, but with the all-important assets of money and position, would wake up to the importance of his ideas and give him the chance he needed.

He thought again of emigrating. Conditions seemed to be more favourable for an enterprising man in America than in England. He had a plan for building steam-boats on the shores of the Great Lakes for the fast-increasing traffic there. If he had carried out his plan, no doubt it would have been a very prosperous one, but fortunately he was still turning it over in his mind when the Hetton Colliery of Durham made him an

offer which put it out of his head for the time being, and before that job was finished other chances offered, and the tide of his fortunes had turned.

The Hetton Colliery wanted their tram-road relaid as a railway, and they asked Stephenson to do it for them. The "Grand Allies" of Killingworth, who had always been most generous masters to him, allowed him to take on the job in addition to his own, without diminishing his salary.

The Hetton tram-road was not very long—about eight miles from the colliery to the banks of the River Wear near Sunderland. It was not a particularly easy piece of work. The colliery, although prosperous, was not so wealthy that it could afford a very expensive line with many "cuts" and "batteries" (cuttings and embankments), nor could it afford to pay large sums to the local landowners for "wayleaves" to make a flatter but more circuitous route. The railway would simply have to go more or less straight from Hetton to the river, following the line of the old tram-road, and crossing whatever ups and downs lay in its path. The railway track was to be a much more durable affair than the thin cast-iron rails of the tram-road, and it was to be mechanised.

Although he loved his engines dearly, Stephenson did not make the mistake of jeopardising their future by trying to make them do the impossible. He had already found that a locomotive was more trouble than it was worth as soon as it began to climb a hill, so he aimed only to use them on the level. He laid down five self-acting inclines on the Hetton railway, but these were possible only where the hill sloped down from the colliery, as all the loaded wagons ran from the colliery towards the river. There were two hills which sloped in the opposite direction, and here, naturally, the empty wagons running down were not able to pull the full ones up. On these hills Stephenson built fixed engines with endless ropes, which astonished a southern visitor when they were working.

"Here and there," he said, "you see careering over the plain, long trains of coal-wagons, without horses, or attendants, or any apparent cause of motion but their own mad agency.

They seemed, indeed, rather driven or dragged by unseen demons, for they were accompanied by the most comical whistlings and warblings, screamings and chucklings imaginable. . . ."

So it appeared from a distance, but when one drew nearer, the stout cables were visible between the rails, and the curious noises could be traced to the grinding and protesting of the tackle.

The plan of the railway from colliery to river was: one and a half miles worked by locomotives, then one and a half miles with a rise of 250 feet which was worked by fixed engines, two and a half miles gradually sloping downhill, which was laid out in self-acting planes, two miles worked by locomotive, and a final half-mile of self-acting incline running down to the staithes. Five locomotives were needed for the levels, and these were planned by Stephenson and built under his direction. The country people called them the " iron horses ", and they moved sedately along at about four miles an hour—not much faster than a horse could plod, but dragging twenty wagons to the horse's one. They were on the same pattern as " Blutcher ", with small wheels, heavy boilers, and a multiplicity of rods and pistons like a cat's-cradle.

The railway took three years to build. Once the plans were drawn out, George left the job of resident engineer to his younger brother Robert. Hetton was thirty miles from Killingworth, and he could afford only occasional visits to supervise the works.

The year the railway was begun Robert left school. He was fifteen now, very tall and slight, and, if possible, rather more engine-mad than his father. The two had great plans for the future, but in the meantime Robert was to have what his father never had, a proper apprenticeship. He was bound apprentice to Nicholas Wood for three years, and to mark his manhood took to smoking a little clay pipe, like the miners did, to keep the smell of gas out of their noses and the coal-dust out of their lungs. His official wages as an apprentice were one shilling a day, out of which he used to spend precisely

twopence-halfpenny on his lunch—a herring, a penny roll and a glass of small beer at the little thatched alehouse in the village.

Several things happened that year beside the building of the Hetton railway and Robert's apprenticeship. Aunt Eleanor left them to marry Stephen Liddell, a colliery mechanic, and shortly afterwards George married again. His wife was the gentlest and kindest of women, and it says very much for her that Robert adored his stepmother and the three lived in the sun-dial cottage as happily as when Aunt Eleanor had been with them.

The Hetton Railway was still only half-built when George applied for the post of engineer to the Stockton and Darlington Railway. The Stockton and Darlington scheme was an old one. The coal-country round Bishop Auckland and Darlington was very rich, and promised great rewards to any one who could work it on a large scale. The chief drawback was the difficulty of getting the coal away from this inland region to the sea. The nearest navigable river was the Tees at Stockton-on-Tees, about eleven miles from Darlington. A canal had been discussed in the 1770's, and then a tram-road was suggested, but it was not until 1817 that a Quaker, Edward Pease, a very far-sighted man of whom it was said that "he could see a hundred years ahead", decided to face the enormous difficulties involved and try to get a Railway Act through Parliament.

His original scheme was a bold one. He planned more than forty miles of railway, the main line to run from Darlington to Stockton, and five branch lines from the surrounding country to feed the main one. It was intended to be a railway for goods traffic. Passengers were not considered at all. There were very few people passing between Stockton and Darlington, and no one had yet had the chance to discover that a means of traffic will create traffic, although Mr. Pease himself, that excellent business man, had some inkling of the matter.

"Let the country make the railroads," he said, "and the railroads will make the country."

Mr. Pease intended his railroad to be a public road. Anyone would be able to use it on payment of the proper tolls, although they would have to provide themselves with wagons with flanged wheels the requisite width apart. Many of his Quaker friends, trusting his judgment, supported his plan (so many that for years it was called "the Quaker's line"), but oddly enough the landowners, coal-owners and merchants of the county, to whom the scheme should have appealed, were loud in their scorn, and refused to buy shares.

The Bill first went before Parliament in 1818, and was thrown out by the personal efforts of the Duke of Cleveland, who did not want his hunting to be disturbed. The motion was, however, lost by only thirteen votes, and more than a hundred Members voted in favour of it, which was a hopeful sign. The Bill went back before Parliament in the next session, but owing to many delays, including the death of the King—old George III— it only received the Royal Assent in 1821. The Act provided for the building of a tram-road or railway (the promoters had not yet decided which it was to be), which was to be open to the public during the hours of daylight. The means of traction was not particularly specified, but the directors were thinking in terms of horse-drawn wagons.

George Stephenson, his Hetton Railway well under construction and himself much advanced in skill and experience—being entirely self-taught he had to solve each engineering problem as it arose by rule-of-thumb and common sense—was taking an interest in the Stockton and Darlington scheme. He had the idea of applying for the post of engineer on the railway. He knew as much about railways as any man in the north. The Killingworth owners would be sorry to lose their engineer, but for some time they had expected to lose him when he found more congenial work, and they provided him with a letter of warm recommendation. George set out for Mr. Pease's house at Darlington, taking Nicholas Wood with him by way of moral support.

The Great North Road leads directly from Newcastle to Darlington, and there were coaches constantly passing between

the two places. George and Nicholas did the thirty miles by an earlier version of hitch-hiking known as "nipping". Instead of buying their tickets and taking their places at the coach office in Newcastle, they met the coach on the road and tipped the guard to let them have a ride. It was not always certain that there would be two vacant places, but it was very much cheaper.

Edward Pease was a man used to sizing up other men, and he liked Stephenson at once.

"There was such an honest, sensible look about him," he said, "and he seemed so modest and unpretending. He spoke in the strong Northumbrian dialect of his district, and described himself as 'only the engine-wright at Killingworth; that's what he was'."

They talked railways all the afternoon, and George was soon riding his favourite hobby-horse of steam-power.

"My engine at Killingworth has been working there six years now," he said, "and it's worth fifty horses. There'll be nothing but such engines on the railroads before you and I are much older, sir."

Mr. Pease was doubtful. He had, he said, never considered locomotives.

"At least come over to Killingworth and see what my 'Blutcher' can do. Seeing is believing, sir."

He and Mr. Pease parted very good friends, although no promises could be made until after the next directors' meeting. George was in high spirits. Even the discovery that they had talked until the last coach was gone, and would have to walk all the way to Durham, did not damp him.

The result of this interview was that the directors, although they shelved for a time the question of locomotive engines, decided to build a railway instead of a tram-road, and employed Stephenson to re-survey it, as it seemed probable that they would have to get a supplementary Act passed, the original one not being quite satisfactory.

A letter to this effect was sent to Killingworth, and the messenger stopped in the village to ask the way to the house

of " George Stephenson, Esquire, Engineer ". Quite a crowd gathered, for letters were rare, and such a distinguished private postman, on horseback, rarer still. But nobody had ever heard of " George Stephenson, Esquire, Engineer ". Blank faces and shaken heads were the only answer, and the man was almost persuaded that he had come to the wrong place, when someone suggested that perhaps it was " Geordie the Engine-wright " who was wanted.

If so, " Go over to the West Moor," they said, " by the road yonder, and when you get there, seek for a cottage by the road-side with a dial over the door. That's where Geordie lives."

It was in the summer of 1821 that the new engineer began his survey, which he would carry out, he assured the Board " with that economy which would influence me if the whole of the work was my own ".

Robert, delighted to be let off from the colliery for the purpose, was his assistant, and the chainman was a colliery lad of the same age as Robert, called John Dixon, who was apprenticed to George Stephenson to learn engineering, and who thought rather more of " Old George " than he did of the Archbishop of York.

They walked and worked from dawn to dusk, sitting under a hedge at midday to eat bread-and-butter and cold potatoes and drink milk fetched from the nearest farm. Robert was in tearing spirits. He hated working underground. He got easily hot and exhausted, and felt as if he could not breathe. He used to wake up in the night in a sweat, gasping for breath, and he knew very well, from his father's and stepmother's grave looks, that they thought he was going the same way as his poor young mother. But now, out of doors, he was as strong as a horse and could keep going for hours.

Stephenson never spared himself, and he never spared his young assistants either. One evening very late, when they had stopped work for no other reason than that the light was gone, they were preparing to go home. George had a lodging in a farm nearby, but the two boys had to walk the four miles into Darlington for their supper and bed. As they were

starting, he called them back to remind them to be early in the morning.

"You're not to set off from Darlington at daybreak," he said, "or we shall lose an hour. You're to be *here* ready to begin work as soon as it's daylight."

The first rail was laid at Stockton in May 1822. That same summer Robert went to Edinburgh to finish his education. Some of the Pease family, and other gentlemen who had made the acquaintance of the thin, clever boy with the lively face, told his father that he ought to be sent to college. George was doubtful at first. He did not, he said, want to turn Robert into a gentleman.

"He's got to work, work, as I've worked before him," he said.

He was persuaded, however, that one session of six months in Edinburgh would be a very useful finish to Robert's education, and would help both of them in the end. So it was decided. The £1,000 from the safety lamp was not to be used for the purpose (that was earmarked for something else, and in any case it was invested and could not be touched in a hurry), but George thought that he could manage the £100 that would be necessary.

Robert knew that the managing would mean a very hard scrape, but he accepted his father's sacrifice and set about repaying it in his own way. He was to go to Edinburgh in the autumn, and all that summer he was hard at work learning shorthand. He knew how to work hard and to work intelligently (the one he had learnt from his father and the other from Mr. Bruce, his schoolmaster), and he was determined to give back every penny's worth of the £100.

At Edinburgh he attended courses of lectures in chemistry, natural philosophy, natural history, and mathematics, which appeared to be the most useful subjects for a budding engineer, and he spent two evenings a week in the laboratory doing practical chemistry. Every lecture he attended he took down word for word in shorthand, and at night transcribed the notes —page after page of that neat, left-handed writing, rather more

mature now, in which he had once written out his father's famous "letter to the papers".

He did not drink in everything the professors told him without criticism, however.

> "Mr. Jameson's lectures [he wrote home] have hitherto been confined chiefly to Zoology, a part of Natural History which I cannot say I am enraptured with; nor can I infer from his Lectures any ultimate benefit, unless to satisfy the curiosity of man. Natural historians spend a great deal of time in inquiring whether Adam was a black or white man. Now I really cannot see what better we should be, if we could even determine this with satisfaction."

He complained that the Latin names of animals and plants, which the Professor used, puzzled him sadly, and he asked his father for £26, which he needed in something of a hurry. During that six months Robert worked long hours in college and at his cheap lodgings in Drummond Street, and although he made some good friends, he was often dreadfully homesick for Killingworth. But he ended the session a much better-educated young man than he had begun it, and he took back to the cottage at West Moor not only his books full of lectures, which he read to his father in the evenings, but a prize for mathematics given him by the Natural Philosophy professor. It was not an official prize, but none the less it was well-earned, and George was very proud of his son. He also took back with him one of the brightest memories of his whole life, that of his first real holiday. At the end of the session the Professor had taken some of his students on a tour through the Highlands of Scotland, partly on foot, partly by boat, with knapsacks, geological hammers, and specimen boxes, and Robert had never enjoyed anything so much.

When he got back to Northumberland he found the new railway well under construction. One of the first things that he had to do was to go to London for a few days to face the Parliamentary Committee on the amended Act. When they surveyed the railway the year before, George, with a generous

impulse, had put "Robert Stephenson, Engineer" on the maps, so it was Robert who had to face the Committee. In any case, although only nineteen, he managed, so far as coherence and ease of expression went, very much better than his father would have done.

The Amended Act was passed. Among other things it permitted the use of locomotives. This was the indirect result of a visit that Mr. Pease had paid to Killingworth, during which George and "Blutcher" between them had quite converted him to the idea of steam.

Robert also found that his father, who had now left Killingworth Colliery for good, was getting engineering work to do all over the country. At first they were only relatively unimportant engagements—colliery railways, pumping engines, self-acting inclines, and things of that sort. But George Stephenson was winning a name and working up a connection, and that was the important thing.

As soon as Robert was at home to help him again, they began on the scheme for which they had been working and saving for years. Stephenson wanted to start a locomotive factory—if factory is not too grand a word. He had already planned and built seven locomotives—two for Killingworth and five for Hetton—and he had taken out patents for various improvements, but he had always been hampered by the lack of proper tools and men trained to use them. Blacksmiths and colliery mechanics had not the degree of skill and precision that he needed for the carrying out of his ideas. So far it had been a vicious circle: until he had his own workshops he could not build a really good engine, and until he had built a really good engine no one was going to be sufficiently impressed to help him build the workshops. But now Mr. Pease had consented to invest £1,000, he himself had the other £1,000, Robert was ready to take on the duties of general manager, and the Stockton and Darlington Company would support the venture by ordering three engines. All that remained was to find a plot of land in Newcastle where they could build a forge and a workshop, with a loft above that would do for a drawing-office.

The firm of "Robert Stephenson and Co." was in fact established next year. Robert's job was a stiff one. "He had to supervise the building operations, engage men, take orders, advise on contracts, draw plans, make estimates, keep the accounts, and in all matters, great or small, govern the young establishment on his own responsibility", while his father was busy on the railway.

It was a family firm. George's two younger brothers, Robert and John, were taken into it (John was killed in an accident there some years later). So was Stephen Liddell, Aunt Eleanor's husband. Some of George's friends and associates sent him their sons as apprentices. One of the likeliest boys was young Joseph Locke, just sixteen, son of a colliery engineer in Barnsley who had been a brakesman with George at Wylam, years before. Another was Thomas Gooch, the son of a Bedlington iron-master. They started, as Robert had done, at a shilling a day.

Robert got the place into working trim within a few months. Among other things he drew up the plans for two fixed engines which were needed on the Stockton and Darlington line. There was a steep hill at Brusselton just out of Stockton which the locomotives could not manage.

Robert did not see the opening of the line, for while it was still building he was offered a job in Colombia, South America, as mining engineer in charge of a silver-mine. Silver-mines were all the rage at that time. Dozens of companies were floated in London to open and work them, and everybody was putting his money into silver-mines, expecting to get rich. Nobody did, but that came later.

Robert was eager to accept the offer made to him by one of Mr. Pease's rich Quaker friends. The salary was £500 a year, and it meant good engineering experience, as well as a most exciting chance to travel. George did not like it at all. The boy was not yet twenty-one, he had been growing like a corn-stalk, and he had never quite recovered from that session in Edinburgh, where, it was now apparent, he had overworked himself most thoroughly. In the end he grudgingly consented,

on medical advice. He took Robert to a doctor in Newcastle, and during the examination Robert felt like a man on trial for his life. The doctor, to his enormous relief, pronounced that three years in a warm climate would set him up and make a new man of him.

The next few weeks, until his ship sailed from Liverpool, were full enough. He spent most of the time in London, ordering stores and seeing to all sorts of things. He had time as well to visit the Mint and see *The Times* being printed—two visits which charmed his mechanical mind—and to have dinner with a great many people. His father had a large engineering acquaintance, and the Peases gave him introductions, and he was a such friendly, charming person that he made friends wherever he went. He enjoyed his stay in London very much.

One of the last things he did was to go down to the railway with his father and John Dixon to see how it was getting on. They spent all day looking at the works, and ended up in Stockton in time for dinner. In honour of the occasion they had a bottle of wine, and when they had drunk Robert's health and success to his career in South America, and the railway's health and success to its career, George made something of a speech.

"Now, lads," he said, turning his glass in his hands and looking at it pensively, "I'll tell you that I think you will live to see the day, though I may not live so long, when railways will come to supersede almost all other methods of conveyance in this country—when mail-coaches will go by railway, and the railroads will be the great highway for the King and all his subjects. The time is coming when it will be cheaper for a working man to travel on a railway than to walk on foot. I know there are great and almost insurmountable difficulties that will have to be encountered, but what I have said *will* come to pass, as sure as you live. I only wish I may live to see the day, though that I can scarcely hope for——"

He shook his head to express all that he left unsaid. He was forty-three—thirty-five years away from the little boy who made clay engines while he guarded the cows. He had not wasted much time in those thirty-five years, and yet how little

had been accomplished. One far-sighted man in all England had commissioned eleven miles of public railway and three locomotive engines.

The Stockton and Darlington Railway was opened on September 27th, 1825. The first train, driven by Stephenson himself, consisted of twelve wagons of coal and flour to symbolise the chief traffic of the line, and twenty-two wagons of

Opening of the Stockton and Darlington Railway

passengers. The Company had had 150 wagons made for themselves, although they expected the bulk of the traffic to be provided by others.

On the day of the opening the correspondent of the local paper sent in an excited report:

> "The signal being given, the engine went off with this immense train of carriages, and such was its velocity, that in some parts the speed was frequently twelve miles an hour,

and at that time the number of passengers was counted to be 450, which, together with the coals, merchandise, and carriages, would amount to near 90 tons. The engine with its load arrived at Darlington, a distance of $8\frac{3}{4}$ miles, in 60 minutes."

The journey back, this time with a brass band tootling itself hoarse in one of the wagons and 600 passengers squeezed in somehow, was accomplished at the decent but not over-hectic pace of six miles an hour.

" The arrival at Stockton excited a deep interest and admiration ", as well it might. The only people who were disappointed were those who had come in the confident hope that the engine would blow up, and felt that they had been deprived of their amusement.

The engine used on this great occasion was No. 1—" Locomotion "—the first engine to be built at the new factory. It weighed about eight tons—twice as much as the later, much more famous, " Rocket ". This was owing to the pattern of the boiler. The heat from the furnace passed through the boiler in one large cast-iron tube, and this tube, in order to do its job of heating the water efficiently, had to be of a size which materially increased the size and weight of the whole engine. Even so, the one-tube system, efficient enough for stationary engines, where size and weight were no drawbacks, was not satisfactory for locomotives. Much of the heat was never used and, encouraged by the steam-blast, went roaring away up the chimney until it was red-hot. Twelve miles an hour was the greatest speed " Locomotion " could manage, and until some means was invented for using *all* the heat from the fire, instead of a small part of it, steam could not be raised in sufficient quantity and at high enough pressure to make higher speeds possible.

But what the old " Locomotion " lacked in speed she made up for in strength and staying power. She was admirably suited to the unspectacular work she had to do, and after dragging heavy trains of coal for more than twenty years she

went into honourable retirement on a pedestal outside Darlington station. In her earlier and more skittish days she once challenged the local stage-coach to a race between the two towns, and won—by 100 yards.

The success of the opening day was immediately cast into shadow by the success of the railway's daily work. This success was largely promoted by its worst enemy. When the Act was going through Parliament, that very important mine-owner "King Jog" Lambton feared for his own export of coals from Sunderland. So he managed to get a clause inserted in the Act forbidding the railway to carry coal for export at more than a halfpenny a ton per mile. The railway, it was thought, could never afford to carry coal for the sea trade at this ruinously low price, and would have to limit itself to carrying coal to intermediate stations along the line, for which it was allowed to charge fourpence a ton. However, at a halfpenny a ton, every coal-owner in the countryside wanted to patronise the railway, and as soon as there were locomotives and wagons enough, the Company had so much traffic that even at that low rate it was showing a handsome profit. Within a short time it was sending coal away by sea at the rate of half a million tons a year.

The wharves at Stockton could not cope with this volume of traffic, so Mr. Pease and his friends lengthened the line a few miles and built wharfs and warehouses nearer to the mouth of the Tees. These wharfs and warehouses, built on a mud-bank near a solitary farm-house, and dignified by the name of Middlesborough, soon impressed people with the power of the railway. Within ten years a town of 6,000 inhabitants had sprung up. Within another ten years the population had doubled, and the town was one of the busiest ports on the north-east coast.

The Stockton and Darlington Railway soon catered for passengers as well as coal, although not in a very large way. A thing rather like a caravan, drawn by one horse, used to travel between Stockton and Darlington twice a day, and the fare for the privilege of tit-tupping along the line at six miles an hour

in this conveyance (hard benches all round and a table down the middle) was one shilling. On winter evenings the driver illuminated it by buying a penny candle and sticking it with its own grease to the middle of the table.

In spite of the discomfort, the passenger traffic grew, and the next year saw an advertisement in the *Durham County Advertiser*:

> "For Rapid, Safe and Cheap Travelling By the Elegant New Railway Coach, the *Union*. Fares: Inside 1½d. per mile, outside 1d. Parcels in proportion. No gratuities expected by the Guard or the Coachman."

This was only the first of a whole fleet of old coach-bodies, painted up new, with the Company's crest on the door-panels, and equipped with flanged wheels to fit the road, which began to ply up and down the line in grand style, quite as fast as the coaches on the highway. They stopped at very frequent intervals to pick up passengers, and, since travelling was thirsty work, every public-house was made a port of call. The trouble was that the line was only a single one, and there were often disputes, or even pitched battles, when two coaches met, to decide which of them should back down the track to the next siding.

For several years after the opening, horses were very largely used on the line. The gradient was almost entirely downhill towards the sea, so that horses could manage the trucks almost as well as the locomotives. Each horse drew several wagons, the last of which was a low "dandy-cart". When the train reached a down gradient, the horse was unhitched, trotted round to the back of the train, jumped into the cart, and stood there, quite unconcernedly eating his hay, while the wagons ran down by their own weight. There was one old grey who knew the ways of the line so well that one day, seeing his train pursued by another that had "run amain", he jumped from his dandy-cart, which would probably be upset in the collision, on to the truck in front, and balanced on the pile of coal until they reached the bottom of the hill and safety.

The idea of a public railway, which had looked so well on paper, was soon proved to be unworkable in face of the immense amount of traffic which wanted to use the line. The plan of letting anyone use the line on payment of a toll brought such confusion that it was soon stopped, and the Company, increasing their rolling-stock, took on all the traffic themselves.

The success of the railway had a great deal of influence all over the country. Although the opening passed with so little remark, except locally, that *The Times* did not even bother to mention it, 1825 saw railroad companies springing up all over the country like mushrooms, and everywhere surveyors were striding over the hills and meadows with their chains and levels. For a year or more excitement boomed, but then a financial crash put an end to all these fine schemes except one—the Liverpool and Manchester Railway.

CHAPTER VI

LIVERPOOL TO MANCHESTER

OWING to the peculiar suitability of the damp climate to cotton-spinning, since the beginning of the Industrial Revolution hundreds of mills had sprung up in South Lancashire. The villages had swollen into swarming towns, and the towns had joined up with one another into larger towns, which were constantly augmented by streams of poor people seeking work, and by the starving Irish from the other side of the narrow sea. The problem of supplying all these people with the necessities of life and the raw material of their trade was every year becoming more urgent.

The cotton-spinning towns had grown up on the misty fringes of the Pennines, where the swift becks could drive the mill-wheels. Their centre and market was in Manchester, but the raw cotton that was their life came through the Liverpool docks. The thirty miles between Liverpool and Manchester was the most congested industrial bottle-neck in the British Isles.

The Duke of Bridgewater's canal had been built in the 1760's, but the traffic increased every year. With the best will in the world, the canal could not cope with it all, and the canal authorities, able to dictate what terms they liked, made no effort to ease things. By 1820 £5,000,000 worth of raw cotton was coming into Liverpool every year and £12,000,000 worth of cotton goods going out again, and the greater part of this immense trade had to go through Manchester. All the wharves and warehouses of both towns were clogged with cotton bales. It took longer to cross that thirty miles than the whole of the long journey from the plantations of the American States to Liverpool.

Even when the bales were at length loaded on to the canal

boats their speed by water was no more than one mile an hour —a leisurely day and a half on the journey. The heavy road-wagons were no speedier. Manchester is notoriously subject to wet weather, and the roads were often too deep in mud for the wagons or pack-horses to move an inch. In a hard winter when the canal froze, supplies stopped altogether and thousands of mill-folk were thrown out of work in a season when they could least afford it.

In 1821 some of the merchants of both towns met to consider the problem, and discussed the possibility of laying down a tram-road. It must be remembered that the people concerned had to face problems of this sort as best they could. There was no County Council or other official local body, and Government Departments did not interfere.

A surveyor called William James, a man of wild and wonderful ideas, passionately interested in railways and steam-engines, offered to survey the proposed line, an offer which was accepted. The survey was made, but although the making of it was exciting enough, the result was not particularly accurate. The work was often interrupted in a fashion that became all too familiar to railway engineers in the future.

Once a Railway Act was passed, the Company were empowered to buy the land they needed, and the landowners were obliged to sell, whether they liked it or not. This tinkering with the traditional liberty of the Englishman made people very angry, especially the landowners whose estates lay in the path of the projected railroad. Not unnaturally they tried to keep the surveyors off their land by all sorts of ingenious methods short of actual murder, and the surveyors had to be no less ingenious to get their work done. Pitched battles were frequent between surveyors on the one hand and colliers, labourers, farmers and gamekeepers on the other. Both sides resorted to hiring gangs of toughs to fight their battles for them.

After James's survey no more was heard of the proposed railway for two years. Then a public declaration was issued, signed by about 150 prominent Liverpool merchants, announcing that in their opinion:

"The present establishments for the transport of goods are quite inadequate, and that a new line of conveyance has become absolutely necessary to conduct the increasing trade of the country with speed, certainty and economy."

This was followed by a prospectus. People were invited to invest in the new road. Four thousand shares were offered for sale at £100 each. No person was to buy more than ten of them—a very wise stipulation, for it meant that no one could buy a too-powerful interest in the affair, and that the venture would have a large body of wealthy men behind it. The main object of the scheme, according to the prospectus, was the carriage of goods between the two towns five times as quickly as by water at two-thirds the price. The prospectus also mentioned, inconspicuously, that the railway would probably prove "a cheap and expeditious means of conveyance for travellers" as well as cotton bales, but no one was particularly interested in this aspect of it. Nothing was said about the means of haulage, although the promoters of the line had twice been over to Killingworth to see Stephenson's engines at work.

The Bill was to come before Parliament in the session of 1824. Mr. James was asked to re-survey the line, but he had got into financial deep water over some of his weird and wildcat schemes, and was leaving rather hastily for France. Before he went he had time to recommend George Stephenson as the best man for the job.

Stephenson carried out the survey, but again it was done in hugger-mugger fashion. The two biggest landowners in South Lancashire—the Earl of Derby and the Earl of Sefton—were violently against such democratic disturbance of their property, and turned all their keepers and dependants on to the watch for the surveyors. They even threatened that the men would be told to use their guns.

Old George had been brought up in too tough a school to mind the prospect of a little rough-housing. He went placidly about his work. When things got too warm, he thought up some way of disposing of the opposition. One night he hired

a gang of poachers to create a diversion with shot-guns at one end of an estate, while he and his men completed their survey by the light of the full moon at the other, unmolested by keepers.

One of his most inveterate opponents was the Duke of Bridgewater's agent, who, as manager of canal property, was not likely to be well disposed towards railways.

" I was threatened to be ducked in the pond if I proceeded," said George afterwards, " and of course we had a great deal of the survey to take by stealth, at the time when the people were at dinner. We could not get it done by night. Indeed, we were watched day and night, and guns were discharged over the grounds belonging to Captain Bradshaw to prevent us. I was myself twice turned off by his men."

The result of it all was that the plans which went before Parliament were very far from perfect. Some of the surveyors, like John Dixon, had had some practical experience. Most of them hardly knew a railway from a canal. George had to teach them as he went along, as at first he had to teach everybody to do everything, from the engineer who designed a viaduct to the last mechanic putting rivets into an engine boiler. Every single thing on the Stockton and Darlington and the Manchester and Liverpool lines was most particularly *his* responsibility, in a way that it never was again. He often wished that Robert had never set out for the silver-mines of Colombia.

The Bill went before Parliament. It went into the Committee stage in March 1825, and witnesses were called on both sides, with the best legal advice that they could afford to hire. The railway promoters did not find it particularly encouraging to think that their chief witness was a Tynesider with an outlandish accent who had the greatest difficulty in speaking in public. The learned counsel retained by the other side would try to make mincemeat of his answers, and the odds were sadly high in favour of their success.

They decided, wisely enough, not to muddle their engineer with too much good advice. He might be hesitant and apparently uncouth, but fundamentally he knew his job, and he must

get along as well as he could on his native honesty and mother wit. Only one thing they briefed him on. He must not talk about the possibility of his beloved locomotives going at twenty miles an hour. That would be fatal to all their plans. The honourable members of the Committee would take flight like a string of wild duck and never approach the idea of a railway again.

"You had better moderate your views," they said, "and bring your engine down to a reasonable speed, or you will damn the whole thing, and they'll think you a maniac fit for Bedlam."

George promised that he would refrain from theorising and remember that the average speed of his Killingworth engines was no more than five miles an hour. It was very disheartening though. He said afterwards that he could not find in all England an engineer to support his views in Parliament. He had to be the only witness for the defence. Young Robert was far away, and in any case his word would not have carried much weight. Even his old friend Nicholas Wood, who was now an engineer of some consequence and had recently published *A Practical Treatise on Railroads*, would not support him.

> "It is far from my wish [he wrote primly in his book] to promulgate to all the world that the ridiculous expectations, or rather professions, of the enthusiastic speculator will be realised, and that we shall see engines travelling at the rate of twelve, sixteen, eighteen, or twenty miles an hour. Nothing could do more harm towards their general adoption and improvement than the promulgation of such nonsense."

Another person, favourable on the whole towards the idea of railways, wrote to the directors:

> "I still think you will not get many who will suffer themselves to be conveyed, even at the rate of *eight* miles an hour, amidst the hissing noise and dense smoke of their own and other passing engines."

If the friends of the railway felt like this, it is hardly surprising that its enemies could not find words savage enough for their disapproval. Stephenson had a wretched time of it before the committee.

"I had to place myself," he said afterwards, "in that most unpleasant of all positions—the witness box of a Parliamentary Committee. I was not long in it before I began to wish for a hole to creep out at. I could not find words to satisfy either the Committee or myself. I was subjected to the cross-examination of eight or ten barristers, purposely, as far as possible, to bewilder me."

It did not make him feel better to hear an audible aside from one honourable Member to another, when he began to speak in his strong accent with the curious "r's" of Tyneside:

"Is this fellow a foreigner?"

But although he hated every moment of the ordeal, he came through the first day's cross-questioning better than he had any reason to expect. Although his opponents were extremely clever and well-educated men, who had studied the subject for the occasion, so long as they were dealing with railways and locomotives he was far ahead of them. All the problems they could raise he had studied long ago. By now he had built fifty-five steam engines, sixteen of them locomotives. As for railways, he had tumbled over the rails of a tram-road before he could walk. Although he fumbled for words and delivered his opinions in a homely, provincial sort of way, he was not without the dignity of complete self-reliance, and the learned gentlemen could not get the better of him.

Would not these locomotives, he was asked, terrify all the horses in the neighbourhood, so that riding, for instance, or ploughing, would be impossible?

"Nay," said the witness; "horses learn to take no notice. Of course there *are* horses that'll shy at a wheelbarrow. Round Killingworth the cattle in the fields go on grazing when the trains run past, and the farmers make no complaints."

Were not terrible accidents frequently caused by the bursting of boilers?

"As to accidents, I never heard of any with *my* engines. I believe I did hear of one once, at the Middleton Colliery near Leeds, but that was a Blenkinsop engine, and the driver was drunk. He put a considerable load on the safety-valve, so of course when the engine moved forward she blew up and the man was killed. That couldn't happen if the proper precautions were taken."

Surely it would be impossible to build a railroad that would bear a train going at a speed as high as twelve miles an hour? Had Stephenson ever seen one that would stand it?

"Yes."

"Where?"

"Any railroad that would bear going at four miles an hour. I mean to say that if it would bear the weight at four miles an hour, it would bear it at twelve."

"Do you mean to say that it would not require a stronger railway to carry the same weight at twelve miles an hour?"

George paused, frowning, to search for his words.

"I'll give an answer to that," he said at last. "I daresay every person has been over ice when skating, or seen persons go over, and they know it would bear them at a greater speed better than it would if they went slower. When you go quick the weight in a manner ceases."

Up jumped learned counsel to put his finger on the weak point in that argument.

"Ah, but is not that on the hypothesis that the railroad is perfect?"

"Ay, it is," answered Stephenson without hesitation; "but then I mean to make it perfect."

Now up jumped learned counsel on the other side, who had been getting restless through all this talk of "twelve miles an hour". He did not want the gentlemen of the Committee to be frightened.

"With regard to all those hypothetical questions of my learned friend," he said to Stephenson, with a meaning glance,

" they have all been put on the supposition of going twelve miles an hour. Now, that is not the rate at which, I believe, any of the engines of which you have spoken have travelled."

" No. Except," he could not help adding, " as an experiment for a short distance."

Learned counsel frowned under his wig.

" But what they have gone has been three, five, or six miles an hour ? " he said with emphasis.

" Yes," said George meekly, taking the hint.

On the whole, he came very well out of the first day's ordeal, and at least once he had much the best of a verbal exchange. He was being questioned on the subject of accidents, about which the Committee appeared to be extremely nervous.

" Suppose, now," said one of them, " one of these engines to be going along a railroad at the rate of nine or ten miles an hour, and that a cow were to stray upon the line and get in the way of the engine. Would not that, think you, be a very awkward circumstance ? "

" It would," agreed the witness, with his charming smile. " Very awkward indeed—for the cow."

On the second day, when the questions shifted ground from the general to the particular, George Stephenson came off badly. He was not nearly so familiar with the details of the Liverpool-Manchester line as he had been with general problems about locomotives, and the lawyers were able to trip him up again and again. Owing partly to inexperience and partly to haste, the survey was full of errors, all of which were joyfully seized upon by the opposition. Some of them were considerable errors, too. There were stretches of the Edgehill tunnel, for instance, which, if they had been bored according to the plans, would have passed right by each other and never made contact at all. This, luckily, was not perceived by the Parliamentary Committee. The errors they did find were bad enough. Besides, Stephenson had made a grave mistake. He had changed certain details of the line after the official plans had been lodged, not understanding that Parliament would confine the Company to the precise estimates first laid down.

His cross-examination lasted three days, and he was as miserable as he had ever been in all his life.

His most severe handling was on the question of Chat Moss. The railway, owing to the opposition of Lord Derby and Lord Sefton, would have to avoid their estates and cross this vast and dreary bog. It was impossible to walk on the Moss except in dry weather. The surveys of it were very imperfect because it was impossible to find a place where the theodolite tripod would stand upright without sinking. One surveyor, a stout and heavy gentleman, had started to sink too, and only saved himself by lying down and rolling back to dry land—a process more entertaining for the onlookers than for himself.

"It is an immense mass of pulp," the opposition told the Committee. "Nothing more. It actually rises in height, from the rain swelling it like a sponge, and sinks in dry weather; and if a boring instrument is put into it, it sinks immediately by its own weight. Who but Mr. Stephenson would have thought of entering into Chat Moss, carrying it out almost like wet dung? It is ignorance almost inconceivable. It is perfect madness. . . . Every part of this scheme shows that this man has applied himself to a subject of which he has no knowledge."

An engineer of many years' experience was then called to give his opinion.

"No engineer in his senses would go through Chat Moss," he said, "if he wanted to make a railroad. In my judgment a railroad cannot be safely made over Chat Moss without going to the bottom of the Moss."

The same opinion was repeated by various people who were well qualified to judge. Nothing, they said, could stand on the Moss short of the bottom—thirty-seven feet below the surface. One could build a viaduct, they thought, if the arches were based on the solid clay at the bottom, or one could dig the entire Moss away and wall up a cutting through it. In either case the labour and the cost of it would be prohibitive.

Stephenson's idea, which he could find no one to support, was to *float* a road over the Moss. The bog was not quite liquid. Men could walk on it with boards like snowshoes

strapped to their feet. In some places horses ploughed on it in the same way. Surely then, the weight of even so large a thing as a railroad could be dispersed over a wide enough area to bear it safely. He felt sure that he was right, and nothing would change his mind. But the derision with which he was greeted sent his spirits down like a stone.

"The man must certainly be labouring under a delusion," said one honourable member to another, surveying the engineer with raised eyebrows.

Stephenson sat in deep depression while over his bent head the lawyer, summing up for the opposition, tore him, his plans, his railway, and his intelligence into small pieces in a smooth, cultivated voice.

"I say he never had a plan—I believe he never had one—I do not believe he is capable of making one. His is a mind perpetually fluctuating between opposite difficulties; he neither knows whether he is to make bridges over roads or rivers of one size or another, or to make embankments, or cuttings, or inclined planes, or in what way the thing is to be carried into effect. Whenever a difficulty is pressed, as in the case of a tunnel, he gets out of it at one end, and when you try to catch him at that he gets out at the other."

George's misery deepened. He *had* been very much to blame over those wretched estimates.

"It is sufficient for me to suggest and to show that this scheme of Mr. Stephenson's is impossible or impracticable, and that no other scheme, if they proceed upon this line, can be suggested which will not produce enormous expense. I think that has been irrefutably made out. Everyone knows Chat Moss—everyone knows that Mr. Giles speaks correctly when he says that iron sinks immediately on its being put on the surface. I have heard of culverts, which have been put upon the Moss, which, after having been surveyed the day before, have the next day disappeared, and that a house, storey after storey, as fast as one is added, the lower one sinks. There is nothing, it appears, except long sedgy grass, and a little soil, to prevent its sinking into the shades of eternal night. I

have now done, sir, with Chat Moss, and there I leave this railroad."

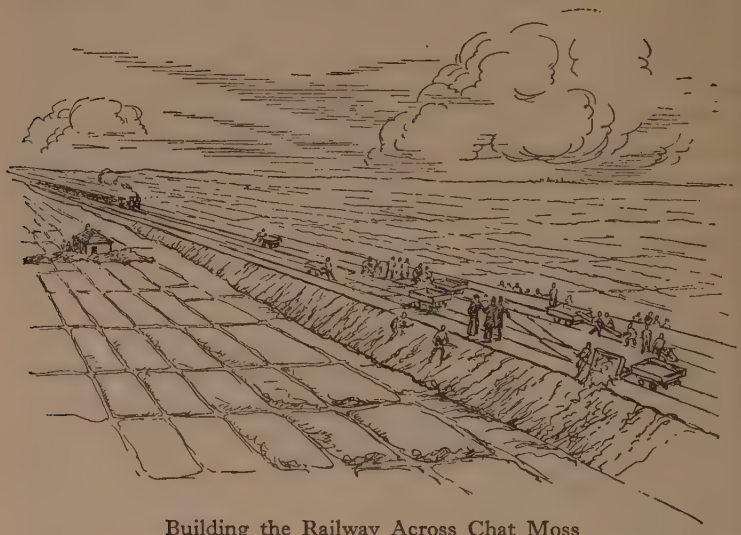
The Bill was thrown out by a spanking majority. The promoters, nothing deterred, immediately called a meeting to lay their plans for getting it through in the session of 1825, but they politely intimated to Mr. Stephenson that they would not require his services for the new survey, and they engaged the great Mr. George Rennie instead.

This was the most crushing blow that Stephenson had ever received, coming as it did at a time when everything was going so well. For a long time he went about like a man under sentence of death, and snapped the head off anyone who came near him. Even the opening of the Stockton and Darlington Railway that summer could not cheer him up very much. His hope of succeeding as a civil engineer seemed to have receded out of all prospect of attainment, and even the Locomotive Factory was in a very unhealthy state—how could it be expected to flourish, when no one would order locomotives?

> "Railways still continue the fashion [wrote Mr. Longridge, who was managing the factory in his absence, to Robert], though I am sorry to add that your father has not that share of employment which his talents merit. It is expected the Liverpool and Manchester Bill will pass this session; perhaps an Amended Act will afterwards be procured. . . . I feel anxious for your return, and I think that you will find both your father and your friend considerably older than when you left us."

The Bill (with some slight changes in the route of the railway to conciliate its most powerful opponents) was passed in April 1826. Once it had received the Royal Assent, the directors turned to Stephenson again. They had only wanted the Rennies, with their greater influence and experience, to get the Bill through. For the actual building of the line they still trusted their original engineer. They had to, because the road was now committed to crossing Chat Moss, and Stephenson was the only man in England who thought that it could be done.

The directors tried to get the best of both worlds by appointing Stephenson as resident engineer and asking Mr. George Rennie to be a kind of engineering overseer and pay six visits a year to the works (at a handsome fee) to see that all was going well. Rennie refused unless they allowed him to choose his own resident engineer (who would not be, he implied, a jumped-up colliery mechanic). The directors stuck to it that they wanted Stephenson to build their line. In that case, said Mr. Rennie,



Building the Railway Across Chat Moss

he would have nothing to do with it, and they could do without his services.

The railway was begun in June 1826. Stephenson, characteristically, started on the most difficult piece of the line first, Chat Moss.

The dreary waste of the Moss, five miles long and three miles wide, was formed on a saucer of hard clay through which the water would not sink. The top of it was bog moss, peat and coarse grass, which held water like a sponge. Ordinary methods of draining were no use at all. Within five yards of a drain

three feet deep the ground remained as wet as ever. It seemed that the Elizabethan poet was not far wrong when he supposed the melancholy waste to be a left-over from Noah's flood. The task of building a solid road through it or over it was colossal. George, when he began the work, knew very well that this was the test of his whole career. If he succeeded, all would go well. If he failed, he would never be heard of again as a civil engineer.

His three assistant engineers were John Dixon, Joseph Locke (promoted out of the factory because he had done very well there), and William Allcard. Thomas Gooch, although he was only nineteen, was chief draughtsman and the engineer's secretary. John Dixon, who was the eldest and most responsible of the three young engineers, was allotted the dubious honour of looking after the Chat Moss piece of line. The first day out, inspecting his length of track, which was marked by a narrow plank pathway across the bog, he slipped off the planks, and immediately sank up to his waist. Struggling only sent him deeper, and he might have disappeared altogether had there not been workmen at hand to pull him out. He decided then and there that Old George had for once bitten off more than he could chew, and determined to resign the impossible job which had been given to him. Joseph Locke succeeded in cheering him up. He did not want Dixon to resign, or *he* might be handed the job, and he preferred his own stretch near Liverpool, tunnels and cuttings and all other difficulties notwithstanding. Dixon was persuaded, but made a mental note not to come out again without boards for his feet like those the workmen wore.

The work began by cutting drains on either side of the proposed road. But the black bog flowed in again as quickly as they were cut. So Stephenson bought up all the empty tar barrels he could find in Liverpool, had the ends knocked out, and nailed them together into a long wooden drain-pipe, which was laid at the bottom of the ditches as they were cut and then covered in to prevent them being pushed up to the surface. This underground wooden drain was found to answer fairly

well, and although the road was far from dry, it was at least not quite so wet. The road was then made of hurdles, branches, bundles of hedge-clippings and heather. It sounds a curious foundation for a railway, but any more normal materials would have been too heavy and have sunk immediately. As this dry pathway advanced across the moss, a little temporary line of railway was laid on it, on which the wagon-loads of materials could be brought up. Each wagon was pushed by a boy, who ran behind it, balancing on the rail, and these boys were soon so expert that they could trot the whole length of the Moss—four miles and more—in half an hour, with a wagon weighing a ton in front of them, and never a false step off the rail.

When the road had been laid with a sufficient width and thickness of these floating materials well packed down, gravel was spread over the top, and the railway sleepers (square stone flags, not the horizontal wooden beams which are used nowadays) were laid in the usual way, and the rails on top of them.

Most of the Moss was bridged very successfully in this way, but at the Manchester end an embankment was needed, for this curious bog was higher in some parts than others. They built it of nothing heavier than dried turf and moss, cakes of which were " skinned " off the top of the Moss all round, but even so it was too much for the sloppy ground to bear, and as soon as about three feet had been built up the whole thing broke through the top skin of tangled grass, and subsided gently into the bottomless bog.

John Dixon went into Liverpool every second Saturday to fetch the money for his men's pay-day, and while he was there he had to go to the Company's office and colour up progress on the wall-chart. Saturday after Saturday there was nothing to add. More than once he looked gloomily at the chart and saw that the work was going backwards. He sent for Old George.

Old George came, dressed in his familiar blue coat and cord breeches, ambling along on Bobby, a real engineer's nag, who would wander up to a locomotive with the steam blowing off

and lay his nose affectionately on the boiler. George rode up and down, heard Dixon's tale of misery, looked at everything, and said "Persevere!" It was his favourite word.

"Keep at it, lad," he said. "You must go on filling in; there's nothing else for it. All the stuff you empty in is doing its work out of sight. Have patience and it will show in the end."

It did, but not before the Company had had a panic over it. They called a hasty board meeting. Perhaps it would be better to build a solid embankment right through the Moss? Perhaps they should build a viaduct from end to end of the bog? Perhaps they should abandon the whole idea and take their railway round another way? In the end they found that going on was a lesser evil than going back. So much money had been spent already that they could not cut their losses.

"There was no help for it," said George. "The directors were compelled to allow me to go on with my plans, of the ultimate success of which I never for one moment doubted."

Besides the difficult crossing of the Moss, there had to be sixty-three bridges built under or over the line, many of them skew bridges, which was a new engineering feat altogether. The Government would not allow the King's highway to be deviated one inch from its proper course, so that if the road crossed the railway at an angle of 45 degrees instead of 90, the arch of the bridge had to be at 45 degrees to accommodate it. The first skew bridge in the country was at Rainhill, where the Manchester turnpike crossed over the proposed line of the railroad. There was also a tunnel at Edgehill a mile and a half long, an enormous cutting through the red sandstone of Olive Mount, and a nine-arch viaduct over the Sankey valley. All these things had to be thought out, planned and built by one man with no sort of precedent to help him. His genius, his superb self-confidence and his capacity for hard work are all equally astonishing.

He had taken a house at Liverpool, where he and his wife lived and where his pupils lodged. Long afterwards, when he had become a well-known engineer on his own account, Thomas Gooch looked back on the rough-and-ready methods of those

early days, amused and not a little proud of his own part in the Liverpool line.

" I may say that nearly the whole of the working and other drawings," he said, " as well as the various land-plans of the railway, were drawn by my own hand. They were done at the Company's office in Clayton Square from instructions supplied in the evenings by Mr. Stephenson, either by word of mouth, or by little rough sketches on letter-paper. The evenings were also generally devoted to my duties as his secretary, in writing (mostly from his own dictation), his letters and reports, and in making calculations and estimates. The mornings were not infrequently spent by me in visiting and lending a helping hand in the tunnel and other works near Liverpool—the untiring zeal and perseverance of George Stephenson never for an instant flagging, and inspiring with a like enthusiasm all who were engaged under him in carrying forward the works."

Within a year from the starting of the work it was obvious that the railway was going to be a success, and the line across Chat Moss was well on the way to completion. Joseph Locke whom Robert accurately described as " a very flowery writer ", wrote to him in South America :

> " Since I last wrote you, many circumstances, at that time highly improbable, have occurred ; and that shade which was unfortunately cast on the fame of your father has disappeared, and the place which he must often have reflected on with pain is now such a scene of operations as sheds lustre on his character, and will no doubt immortalise his name."

Robert, meanwhile, had been getting his experience the hard way. The prospect of rich silver-mines in Colombia was not nearly as hopeful as he and the London Company had been led to suppose, chiefly because of the impassable nature of the country, which was not only mountainous, but frequently shaken by earthquakes.

The local inhabitants promised that silver would be obtained in enormous quantities, but he soon found that they would

promise anything, including brass and steel-mines! The miners sent out from England were drunken and lazy, and, being all Cornishmen, resented an ignorant north-countryman, and a boy of twenty-one at that, pretending to know anything about their trade.

Robert had been given *carte blanche* in the matter of this mine. He could start operations where he liked, do anything that he liked. The only thing that the London Company wanted was a good return for their money. They hopefully sat back and expected shiploads of silver to arrive.

The country was wonderfully picturesque and, in the hills, not unpleasantly hot. Robert's cottage of bamboo and palm-leaves stood beside a river which ran down from the snow-clad mountains which could be seen in the distance. All round was the forest, always green, full of flowering magnolia trees and waving palms, with parrots and pelicans and humming-birds, and cloud upon cloud of jewelled butterflies.

Robert used to travel about on mule-back, wearing, by way of local colour, a tall hat of plaited straw and a red-and-blue blanket—what they call in the Argentine a *poncho.* Apart from the difficulties of his work he was not without amusement. He quickly made friends among the English and French residents, who used to come up into the hills to stay with him. Sometimes he would go down to one of the towns in the plains to a ball or a horse-race. The authorities were charming to him, but they were dilatory and quite unhelpful, the local peasants did not understand the meaning of the word " work " —or at least, not as a Northumbrian miner understood it—the English miners were mutinous, and the London Company kept writing to complain that they were not getting the results they expected.

He stuck to the job and carried it along as best he could, but he had fever and dysentery and was miserably homesick. At first he had letters by every mail from all his friends at home, but, as often happens, these became fewer, and during the last year of his time he did not receive a single letter from his father or stepmother. He decided to leave as soon as his

three years was up. The Company, when they found that he had really made up his mind to go, begged him to stay. They even got in touch with his father in England, asking him to use his influence, and promising to make it worth his while, but George was having nothing of the sort. In spite of being a bad letter-writer, he wanted Robert at home as much as Robert wanted to come.

If he needed any additional persuasion, it was given him by a letter from Edward Pease, advising him to come home and see to his factory:

> "I can assure thee [wrote the Quaker] that thy business at Newcastle, as well as thy father's engineering, have suffered very much from thy absence, and, unless thou return soon, the former will be given up, as Mr. Longridge is not able to give it that attention it requires; and what *is* done is not done with credit to the house."

The factory, indeed, was in a very poor way. There was little work being done, and the accounts were in a glorious muddle. George was continually occupied in Liverpool, and neither of his brothers had any sort of head for business. Mr. Pease had tried to give up his share in it, but Stephenson had not the money to buy him out. He would not give up the works, but they were swallowing every penny of his salary of £1,000 a year from the railway company, and another £300 a year of Robert's salary which he had directed should be paid direct to his father, foreseeing that before he came home it might be needed.

This disturbing news brought Robert back across the Atlantic faster than anything else. His time was up in the summer of 1827, but it was not until November that he reached Liverpool. First another dose of malaria delayed him, and then he had to come via New York, as there was no ship sailing direct.

By a very strange coincidence, on the way home he met Richard Trevithick, that singular genius, stranded penniless on the wrong side of the Atlantic. He had gone out to the silver-

mines in 1816—more than ten years before. Robert lent him £50, which he had no intention of asking for again, and went on northwards to New York, where he wanted to see how the Yankees built their steam-boats, which he had been told they did better than anyone else in the world.

He did not reach home without a number of other adventures, including the tail end of a hurricane which wrecked his ship.

"On voyaging towards New York [he wrote home] after we had made the land, we ran aground about midnight. The vessel soon filled with water, and, being surrounded by the breaking surf, the ship was soon split up, and our situation became perilous. Masts and all were cut away to prevent the hull rocking; but all we could do was of no avail. About eight o'clock on the following morning, after a most miserable night, we were taken off the wreck, and were so fortunate as to reach the shore. I saved my minerals, but Empson lost part of his botanical collection. Upon the whole, we got off well; and, had I not been on the American side of the Atlantic, I 'guess' I would not have gone to sea again."

CHAPTER VII

THE "ROCKET"

THE railway was nearly finished before the directors made up their minds about the method of locomotion. The idea of horse traction was early abandoned, as there was obviously going to be great pressure of traffic on the new line, but it was difficult to decide on the best mechanical method. Dozens of ideas were submitted by inventors and engineers, some of them practicable and some crack-brained. Atmospheric pressure, electricity, water-power were advocated, as well as steam. Even among those who recommended steam, no two people seemed to agree exactly. Some said smooth rails, some said rough rails, some said toothed rails with cogged wheels to run on them, some said rollers between the lines. Some said locomotive engines and some said fixed ones and ropes.

George Stephenson, of course, said smooth rails and locomotives. He said it loud and long and over and over again, but he had not very many supporters. He knew that the ungainly, grasshoppery "Locomotion" and others of her tribe were only baby dragons who would grow into the most powerful monsters in the world. But many people thought that they were the final development of a useful device which could not be further improved. It was supposed to be impossible (as indeed up to this time it had been impossible) to build an engine which could keep up sufficient steam in its boiler for high-speed running, and even if this were done, it was still more widely supposed that at high speed the smooth wheels would fail to grip the smooth rails, and would spin uselessly. Hence all the suggestions about cogged wheels and rollers.

The regular engineers were not disposed to regard Stephenson with respect, for he was an amateur, a quack, an outlandish Tynesider who had messed about a bit with engineering and so

set himself up as an authority on railroads. People like Telford and the Rennies were highly suspicious of such unprofessional behaviour.

The directors of the railway had more faith in their engineer. He had done the impossible once—there was the road across Chat Moss to prove it. But although they agreed with him on the subject of steam, they could not decide between locomotive engines and fixed ones. On the stretch of thirty-five miles about twenty-one fixed engines would be needed. The cost of building these would be high, but running costs would be low. Two eminent engineers were consulted, and they, while generally favourable to the locomotive, decided in this case in favour of fixed engines.

But the directors could not easily shake off George Stephenson. He knew he was right about his engines. This was the chance he had waited for so long, and if this slipped past him, the development of the locomotive would be delayed another ten years at least.

His "It *can* be done, if only you'll give me a chance", rang in their ears at every board meeting. His best argument, besides sheer importunity, was that locomotives, although expensive at the outset, would be much more reliable than fixed engines. The number of them could so easily be varied to suit the traffic on the line. A broken locomotive could be withdrawn without any trouble, but a broken fixed engine would cause a pile-up of traffic behind it until it could be repaired.

The directors, persuaded at last, agreed not to pursue their fixed-engine scheme until they had given a fair trial to the locomotive which would cost them little and commit them to nothing, and they offered a prize of £500 for an improved locomotive.

The conditions for what *The Times* called "The Grand Mechanical Competition", published in the newspapers in 1828, were as follows:

1. The engine must effectually consume its own smoke.

2. The engine, if of six tons weight, must be able to draw after it, day by day, twenty tons weight (including the tender

and water-tank), at ten miles an hour, with a pressure of steam on the boiler not exceeding 50 lb. to the square inch.

3. The boiler must have two safety-valves, neither of which must be fastened down, and one of them completely out of the control of the engine-man.

4. The engine and boiler must be supported on springs, and rest on six wheels, the height of the whole not exceeding fifteen feet to the top of the chimney.

5. The engine, with water, must not weigh more than six tons; but an engine of less weight would be preferred on its drawing a proportionate load behind it; if of only four and a half tons, then it might be put on four wheels. The Company to be at liberty to test the boiler, etc., by a pressure of 150 lb. to the square inch.

6. A mercurial gauge must be affixed to the machine, showing the steam pressure above 45 lb. per square inch.

7. The engine must be delivered, complete and ready for trial, at the Liverpool end of the railway, not later than the 1st October, 1829.

8. The price of the engine must not exceed £550.

The Company reserved the right to buy as many of the competing engines as they liked at the price of £550 each, and to the makers of the winning engine they would pay £500 extra as a prize. They wanted a good, reliable engine, and therefore they had set their conditions fairly low, particularly in the matter of speed. Ten miles an hour was the speed of a good stage-coach, and to have demanded more than that at this point would merely have outraged public opinion. So long as the journey between Liverpool and Manchester could be done in three hours, the directors would be quite content.

The publication of the conditions was received by the Stephensons with pride and excitement. It was what George had been fighting for all along—a chance for the locomotive. Many engineers would be tempted to turn their interest and skill to good account now, who had neither time nor money to spare for experiments when there was no chance of the completed engine being sold. If this trial were a success, loco-

motive steam-power would have come to stay, and the firm that built the winning engine would have made a position for itself that could not be challenged for years.

The factory of Robert Stephenson & Co. was flourishing. Since Robert had returned from South America at the end of 1827 he had worked hard to put it back on its feet. They had made machinery for the South American mining companies. They had made two engines for a railway in France. They had sent at least one locomotive to America. All this work Robert had overlooked most carefully for the locomotive factory was far more important to him than his work as a civil engineer, and always remained so, even when he made a fortune at the latter trade. He had also helped his father for some weeks on the Liverpool and Manchester line, and done some work on his own account on the Canterbury and Whitstable Railway, the Leigh and Kenyon and the Warrington branches of the L. & M.R. These were only short stretches, but they all meant hard work and much travelling, and they meant that Robert, only twenty-five years old, was making a name for himself. Somehow, he had found time to renew the acquaintance of a young lady called Miss Fanny Sanderson, whom he had met before going abroad, and marry her.

She was an attractive and charming girl, with lovely eyes, and the most enormous tact in managing her husband, so that he had no idea that he was being managed. As his chief work was the factory, they took a house in Newcastle. It had to be a very small house, because there was little spare money. Although the factory was beginning to pay its way, it was only beginning, and there was not much profit for anybody out of it as yet. Robert and Fanny were married in June 1829, in London, and their wedding tour, from London to Newcastle via Wales and Liverpool, took approximately a week. After that Robert had to go back to the works, for barely three months remained before the Liverpool competition, and his engine was hardly begun.

Even more than his father, Robert lived, breathed, and ate railway engines.

> " I have been talking to my father a great deal [he said in a letter to Mr. Longridge] about endeavouring to reduce the size and ugliness of our travelling-engines, by applying the engine either on the side of the boiler or beneath it entirely, somewhat similarly to Gurney's steam-coach. He has agreed to an alteration which I think will considerably reduce the quantity of machinery as well as the liability to mismanagement."

This alteration was the direct connection of the pistons with the driving-wheels. It improved the look of the engine out of all recognition, and it increased the power a little, but not enough. The chief problem was still how to increase the heating surface inside the boiler. Robert had been hard at work trying to solve it, with the help and advice of his father, ever since he came home, but the publication of the competition rules made it more urgent than ever. Without some improvement of the sort, they could not hope to make an engine which would win the competition as thoroughly as it had to be won if the power of steam were to be well established. A slight improvement on " Locomotion " and her kind would not do. Robert wanted to build an engine which would make everyone gasp.

The " Lancashire Witch ", which was made for the little Bolton and Leigh Railway (a short branch of the Manchester and Liverpool), had a flue which doubled back on itself, and so went twice through the boiler instead of once. This was a slight improvement, but it was made at the cost of increasing the engine's weight to twelve tons.

" The ' Lankshire Witch ' is rely doing wonders", George wrote enthusiastically (his secretary having obviously gone out for the day). But, although it was an improvement, the doubled flue did not solve the problem.

The two engines which were made for France had the water led through the fire, instead of the fire led through the water. But the small tubes containing water were not at all satisfactory, for they very quickly furred with lime and then burnt

out. Another experiment was the engine called "The Twin Sisters" because she had two flues, two fire-boxes, and two fires. This engine was an extremely heavy one. A pet idea of Robert's own was a single flue with two smaller ones branching off from it. The trouble with this was the difficulty of making the bent tubes.

Robert wrote a depressed letter about this problem to his father, who sent back a hopeful reply:

> "I am quite aware that the bent tubes are a complicated job to make, but after once in and well done it cannot be any complication in the working of the engine. This bent tube is a child of your own, which you stated to me in a former letter. The interior of a watch looks complicated, but when once well fit up, there needs very little more trouble for one hundred years, and I expect the engine you are fitting up will be something similar to this watch with respect to its working parts."

In the end it was neither of the Stephensons, but Mr. Booth, secretary to the railway and a keen amateur engineer, who told George that he thought he had hit on the solution, which, like most excellent ideas, was quite simple. He suggested that the heat from the fire should be led through a great number of small tubes instead of one large one. He discussed this with George, who immediately saw the beauty of the idea, dashed off a rough pencil sketch, and sent it to Robert, who began making experiments that very same day.

The single flue of the old engines had been made of cast iron about half an inch thick, and was commonly about eighteen inches in diameter. The new boiler was to have instead twenty-five small flues, or tubes, each two inches in diameter, and made of copper an eighth of an inch thick. Not only was the heating surface greatly enlarged, but fire and water were separated by an eighth of an inch of copper instead of half an inch of iron.

On this principle "Rocket" began to take shape in the workshop. The boiler was an iron cylinder lagged with wood, six

feet long and three feet across. It was only half-filled with water, the upper half serving as a reservoir for the steam. The

Rocket
Picture and diagram

twenty-five pipes from the fire-box were in the lower half of the boiler, below the water surface. The normal pressure in the boiler was 50 lb. per square inch, and a mercurial gauge,

high up on the tall chimney, showed the pressure. The two cylinders were outside the boiler at an angle of 45 degrees. Robert wanted them lowered to a horizontal position, but his father would not have it. The piston-rods drove the large front wheels, and the smaller hind ones were free.

Everyone in the works was enthusiastic about " Rocket ". They said that she was the neatest, canniest little engine that had ever been seen. " Locomotion " and " Lancashire Witch " were deformed monsters beside her. Robert did a lot of work on her himself, and what he could not do he overlooked minutely. " Rocket " was the darling of his heart.

The trickest part of the work was fitting the copper tubes into the boiler. They tried it first with brass screws, but when the steam was raised a trickle of hot water ran out of every joint. As the steam rose the trickles became scalding jets, and before they could rake the fire out and cool her down the workshop was flooded and the place thick with steam. Every face was as long as a boot and Robert was nearly in tears. He sat down in the office and wrote to his father that it was no good, the plan had failed, and since there was not time to build another engine they must count themselves out of the competition.

But next morning the dogged family spirit had taken hold, and by the time a letter came from Liverpool telling him to " try again " and " persevere ", he was already trying again, the very solution which his father suggested. Instead of fixing in the tubes with brass screws, he fitted them into holes bored for them in the boiler end. Heat expanded the copper, and the hotter the tubes grew the more tightly they fitted. There were no more leaks and no more trouble, and very shortly afterwards " Rocket " was finished and taken to Killingworth for trial. There she made a great sensation. The little engine shone like a butterfly in the racing colours that Robert had chosen for her. Her woodwork was painted daffodil-yellow picked out with black, and her tall funnel was white. She ran better than he had ever hoped, and he wrote an enthusiastic letter to his father the same evening. Next day " Rocket "

was sent by wagon to Carlisle, and thence shipped to Liverpool. The Stephensons' troubles were not yet over. The boat carrying the engine was so long overdue at Liverpool that she was given up for lost, and the insurance money had actually been paid before she turned up, still in good time for the trial.

A part of the line called the Rainhill Level, about nine miles from Liverpool, and just west of the famous skew bridge, had been chosen for the competition. A second line of track, with all the necessary points and sidings, had been laid down over the course. A stretch of a mile and a half was marked with white posts at either end, and beyond the posts was another furlong for the trains to stop and reverse. This was none too much, for the wagons had neither brakes nor buffers, and if the engine stopped too suddenly they ran into one another with a hideous noise, and might quite well knock themselves off the rails.

There had been at least ten engines under construction in various parts of England, but only four were ready in time to appear on the course.

" Rocket " was entered in the names of Stephenson and Booth. Mr. Booth was to have a half-share in the prize, as the multi-tubular boiler had been his suggestion.

" Sans Pareil " was an enormous black engine picked out with green and yellow. It was the largest and heaviest of the competitors, and while the fireman stoked it from one end, the driver stood on a platform at the other. Timothy Hackworth, its builder, had been one of the Wylam team of engineers under Mr. Blackett, and had therefore an even longer experience of locomotives than Stephenson. When he built " Sans Pareil ", he was locomotive foreman on the Stockton and Darlington Railway.

" Novelty ", entered by Messrs. Braithwaite and Ericsson of London, was the most unusual of the competitors. It was painted blue, and as all the metal-work was copper, its appearance was extremely elegant. It was built all in one, on four wheels, without a tender. The boiler was set upright,

the water-tank slung very low, between the wheels and under the platform, and the coke was carried in baskets. It was a very neat and lady-like little machine, and beside it " Rocket " looked a North-country bumpkin, strong, square, but not particularly graceful.

" Perseverance ", belonging to Mr. Burstall of Edinburgh, was black with red wheels. Its career was very short, and no authentic drawing of it remains, but it was probably more like " Novelty " than the others.

Novelty

There were two other machines which could not be officially entered as they were not steam-driven. Mr. Brandreth of Liverpool had made a machine which he called " Cyclopede ", worked by two horses on a kind of treadmill. It moved very little faster than if the same horses had been pulling it on the ground, and its career ended on the second day, when one of the horses fell through the floor. Mr. Winan had constructed an ingenious trolley worked by hand-power, much like those which gangers still use on the permanent way.

The morning of the trial brought an immense crowd to Rainhill—at least 10,000, some said as many as 15,000. Engineers of all ages and classes, professional and amateur, had

swarmed to Liverpool for the occasion. Many of them had taken the rough roads over the Pennines from Newcastle and Durham, where there were more mechanically minded men to the square mile than in all England beside. Those who could not afford the coach fare had walked all the way, and would walk back again.

Besides these, who were mostly sober, knowledgeable, friendly people, ready to share their bread and meat with one another in the shelter of a stone wall and embark on endless technical discussions, there were all the local visitors. Some of these had an interest in the land or the railway or the engines. To the vast majority it was just an exciting and novel entertainment.

Half-way down the course a grandstand had been erected, where the Liverpool and Manchester ladies sat in a perfect whirlwind of bonnets and shawls and fluttering ribbons. Among them Mrs. George Stephenson and young Mrs. Robert, just six months married, sat side by side, as excited over the result as any engineer on the ground. The gentlemen strolled about, and the servants carefully drove the curricles and barouches and chaises and phaetons to a safe distance, where the horses would not be frightened by sight or sound of the smoking monsters. There was the inevitable brass band, and the inevitable hawkers of refreshments, and the inevitable pick-pockets, and the whole scene was as gay as St. Leger day on Doncaster race-course. Three hundred stalwart navvies, on holiday from their work on Chat Moss, were hard at work as special constables trying to keep the spectators off the track.

At ten o'clock precisely a puffing and a panting in the distance and a plume of white smoke heralded " Rocket ", driven by George Stephenson himself and drawing a carful of the directors, all looking very pleasant and gracious, with white favours in their buttonholes.

That morning all the engines (with the exception of " Perseverance ", which had come to grief on the road from Liverpool) showed off up and down the line. " Rocket ", having shed its carriage, managed twenty-four miles an hour, and was cheered

all along the line, except where cheers died away into astonished silence. Since the beginning of things, no one until this moment had travelled faster than the speed of a galloping horse. The audience stood and marvelled at this undreamt-of exhibition of speed. Even those who knew that in theory it was possible were amazed and delighted when they saw the reality. " Rocket's " pounding cylinders had something of the appearance of legs, and to that extent it was faintly familiar, but " Novelty ", with her cylinders and pistons concealed, skimmed along like a blue-and-gold swallow, and was an even more astonishing sight.

> " The speed of all the other locomotive carriages [wrote the reporter of *The Times*] was far exceeded by that of Messrs. Braithwaite and Co's beautiful engine from London. It was the lightest and most elegant carriage on the road yesterday, and the velocity with which it moved surprised and amazed every beholder. It shot along at the amazing rate of *thirty* miles an hour! It seemed, indeed, to fly, presenting one of the most supreme spectacles of human ingenuity and human daring the world ever beheld. It actually made one giddy to look at it, and filled thousands with lively fears for the safety of the individuals who were on it, and who seemed, not to run along the earth, but to fly, as it were ' on the wings of wind '."

Even John Dixon, although obstinately loyal to the Stephensons, was impressed. He wrote to his brother James :

> " The London Engine of Braithwaite and Ericsson called the ' Novelty ' was a light one. . . . Boiler Bellows Flues &c. all covered with Copper like a New Tea Urn all which tended to give her a very Parlour like appearance and when she started she seemed to dart away like a Greyhound for a bit. . . ."

It soon became apparent that the trial was between " Rocket " and " Novelty ". " Perseverance " could never get up enough

steam to go more than five miles an hour, and " Sans Pareil " was disqualified after numerous breakdowns.

> " Timothy has been very sadly out of temper ever since he came " [wrote John Dixon] " for he had been grobbing on Day and night and nothing our men did for him was right, we could not please him with the Tender nor anything : he openly accused all G.S.'s people of conspiring to hinder him. . . . He burns nearly double the quantity of coke that the Rocket does and rumbles and Roars about like a Empty Beer Butt on a rough Pavement and moreover Weighs above $4\frac{1}{2}$ Tons consequently should have had six wheels and as for being on Springs I must confess I cannot find them out either going or standing . . ."

Although rejected by the Liverpool line, " Sans Pareil " was by no means a complete failure. She worked on the Bolton and Leigh Railway for some years, and then, dismantled from her under-carriage, ended her days as a stationary engine.

As soon as he set eyes on the trim little " Novelty ", Stephenson knew that she was " Rocket's " only serious rival. He sent a message to Robert telling him to get someone to look carefully to " Rocket's " water supply and to pick over the coke. They could not afford clinker in " Rocket's " furnace if she was to beat this rival. The two engines had a friendly trial before the real business of the day began, and " Novelty " shot past " Rocket " like an arrow. " Never ", said her engineer years afterwards, " can I forget the look on Robert Stephenson's face at that moment." But on that very first trip, after amazing the spectators by her thirty miles an hour (on at least one subsequent occasion she doubled that speed), " Novelty " was brought to a halt by some engine trouble.

" Eh, man," said George Stephenson, with a grin, " we needn't fear yon thing. It's got no guts."

The trial dragged on for some days. Rain interrupted it once or twice, when the track became too deep with stirred-up mud for the engines to run safely. On the third day, when it was obvious that the conditions had been more than fulfilled, the three

judges (Nicholas Wood, George's old friend from Killingworth, was one of them) advised the directors to publish a new set of conditions.

The new conditions were: that each engine, with its load, was to do ten laps up and down the line—the equivalent of a journey from Liverpool to Manchester—and, after a pause for refuelling, was to do the return journey. The average speed including stops, was not to be less than ten miles an hour.

Robert accepted the new conditions confidently, but the owners of "Novelty" protested, and asked for a few days' grace in which to tinker with their machine. "Rocket", which had been running every day to amuse the spectators, without a trace of difficulty or defect, and had brought up its load of passengers every morning and taken them home every night, needed no tinkering. She did her trial the day after the new conditions were published.

With thirteen tons weight behind her, she did the first thirty-five miles in three hours ten minutes, or at something over eleven miles an hour, and the second thirty-five miles at something over twelve miles an hour. This speed included the stops for reversing at the end of each lap. On a straight course she would have done a steady fifteen miles an hour, which was more than satisfactory, especially as she used only half a ton of coke for the whole seventy miles.

There is no doubt that she could have done it faster, but the Stephensons were cautious men, and they were even more anxious to establish a reputation for reliability than to break a speed record. They both hated shoddy workmanship more than anything in the world. That "Rocket" could be whipped to a good speed was proved the day after, when, unofficially, and without carrying any weight—not even a tender—she did a couple of laps at thirty-two miles an hour.

"Novelty", after breaking down several times, was at last declared ready for her trial. But in the third lap yet another mechanical defect was discovered, and the young Swedish engineer, John Ericsson, lost his temper and withdrew his engine from the contest.

The railway directors bought "Novelty" at the stipulated price, in spite of her various troubles, and ordered two more engines on the same pattern, but they were never successful. Ericsson cheerfully referred to them afterwards as "very classical, but miserably inefficient." They were very soon withdrawn, if indeed they were ever in actual use on the railway.

"Novelty" was a beautiful machine, but too hastily made (the makers only heard of the contest by chance, seven weeks before the closing date), and Ericsson was even farther ahead of his time than Stephenson was ahead of his. "Novelty" should have been used, not for heavy work on the railways, to which she was quite unsuited, but as a private carriage on a public road. As "Rocket" was the sire of all steam-engines, "Novelty" should have been the sire of all motor-cars, but people's minds were not working in that direction at the time, and no further development was made until the internal-combustion engine appeared some fifty years later.

After "Novelty" was withdrawn, the judges' decision was not a difficult one, and Robert Stephenson was awarded the prize. Nine more engines were ordered from the Newcastle factory, and the twenty-one fixed engines, with their complication of cables and tackle, were never heard of again.

The trial was a triumphant success, not only as a personal victory for the Stephensons, but—what they cared for much more—as a vindication of the locomotive. Public opinion swung round like a weathercock. Whereas earlier in the year the Act for the Newcastle and Carlisle Railway had only been passed on the express condition that the railway should *not* be worked by locomotives, but by horses, by the end of 1829 Robert was writing to a friend, "The trials at Rainhill of the locomotives seem to have set people railway mad". He and his father had all the railway work they could manage, and found themselves overnight being boosted up the ladder to fame and fortune.

CHAPTER VIII

THE GREAT DAY

ALTHOUGH the track between Liverpool and Manchester was completed by the end of 1829, and there was a certain amount of local traffic during the following summer, the grand and formal opening of the railway did not take place until September 15th, 1830—nearly a year after the Rainhill Trial.

The great day was to be celebrated by a procession of no fewer than eight trains from Liverpool to Manchester, and many important guests had accepted invitations to be present, among them the Duke of Wellington and Mr. Huskisson, who was Member of Parliament for Liverpool and a keen supporter of the railway. Nearly 800 guests were invited, and each was issued with a numbered ticket, corresponding to a place in one of the trains, so that there should be no unseemly pushing and shoving. The public imagination was fired by the prospect of this gorgeous and unique outing, and fantastic sums were offered for tickets by those not lucky enough to have been invited.

> "Liverpool was never so full of strangers [said the *Courier*]. They poured in during the last, and the beginning of the present, week, from almost all parts of the three kingdoms, and we believe that through Chester alone, which is by no means a principal road to Liverpool, four hundred extra passengers were forwarded on Tuesday. All the inns in the town were crowded to overflowing, and carriages stood in the streets at night, for want of room in the stable yards."

All the shops were full of souvenirs, and there was a brisk trade in sheets of coloured lithographs of the line. Handkerchiefs, trays, jugs, and mugs were all painted with replicas of

" Rocket ", " Novelty ", and the more picturesque scenes of the railway. One could even buy peepshows which opened out into gorgeous paper panorama of the whole journey between Liverpool and Manchester.

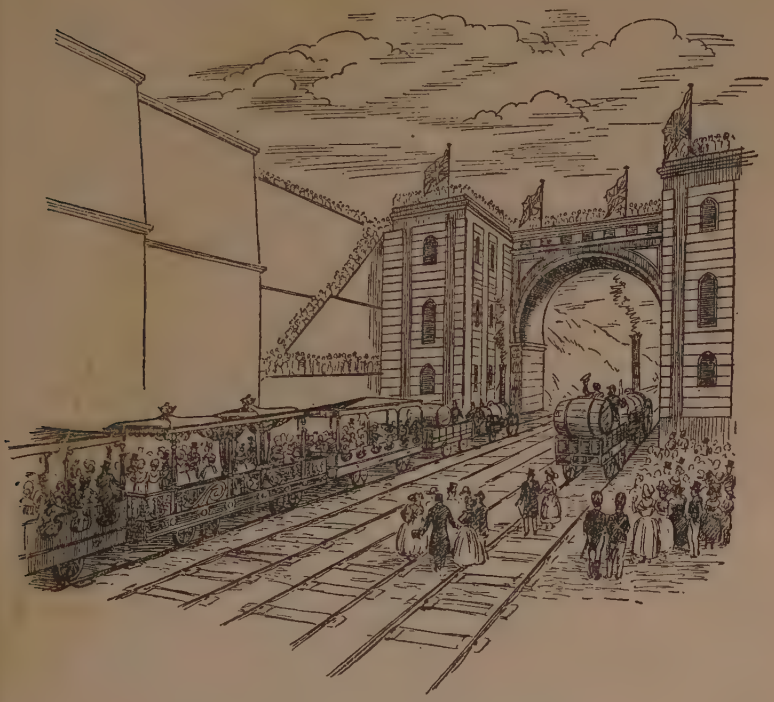
The eight engines which were to be used in the procession had all been built by the Stephensons, whose factory had been working at full pressure since " Rocket's " triumph at Rainhill. Ericsson's two new engines on the pattern of " Novelty " (patriotically named " William the Fourth " and " Queen Adelaide ") had been finished and delivered, but they had not yet been tested on the track, and so were not used. The Company were extremely anxious to avoid any accidents on this auspicious day, and endless trouble had been taken to ensure that all went well. They had even had all points and crossings taken up, except at three places on the line, in case any of the carriages might be derailed.

" Northumbrian ", " Phoenix ", " North Star ", " Rocket ", " Dart ", " Comet ", " Arrow ", and " Meteor " stood in proud line in Edgehill station that September morning. There had been many changes and improvements in the past twelve months, and " Rocket " was no longer the wonder she had been at Rainhill. Even though Robert had tinkered with her a good deal since then, and lowered the cylinders to a horizontal position, as he had always wanted to do, she was only fourth on the list, and would have been fifth but that " Planet "—latest and best of the Newcastle locomotives—was still crated in the hold of some boat in the Liverpool docks, having been delayed on the way from Carlisle.

" Northumbrian " drew only three carriages, but her train made up in splendour for what it lacked in mere length. The first contained the inevitable brass band, the second the Duke of Wellington and other very important people, the third the directors of the Company. The Duke's carriage, or rather triumphal car, was " truly magnificent ", according to one enthusiastic reporter.

It was ten yards long and eight feet wide, and ran upon eight wheels.

"Its workmanship was perfect and tasteful, superb Grecian scolls and balustrades, richly gilt, supported a massy handrail running round the carriage . . . the drapery was of rich crimson cloth, and the whole was surmounted by a Ducal coronet."



Opening of the L. & M.R., Edgehill

The other carriages were far less beautiful. Some of them were the ordinary closed carriages which had been ordered for use on the line, but as there were not enough of these, trucks had been fitted with benches and cushions for the occasion.

As no locomotives were allowed within the town limits, by Act of Parliament, the carriages were marshalled at the station in Crown Street, and then drawn through the Edgehill Tunnel

by ropes to where the engines waited at the other end. The tunnel, lighted by gas, had been a show-place at a shilling a head for some months past, and gliding through its cavernous gloom was the first great excitement of the day, for most of the 800 passengers had never seen a tunnel before.

At Edgehill station the trains of carriages, gaily decked with silk flags of different colours, were attached to their respective engines. The arrangements, carefully worked out by Joseph Locke and Thomas Gooch, went without a hitch.

George Stephenson himself naturally drove "Northumbrian". Robert followed with "Phoenix". His uncle Robert, George's brother, drove "North Star", Joseph Locke drove "Rocket", and Thomas Gooch drove "Dart". Three more of Stephenson's young men had charge of the last three engines, William Allcard in "Comet", Frederick Swanwick in "Arrow", Anthony Harding in "Meteor". Steam was a wonderful and romantic thing to all of them, and there cannot have been one whose heart was not lifted with excitement as they waited. Ahead of them stretched the shining rails, vanishing into the distance, symbol of a new age—an age of steel and steam—and under their restraining hands throbbed the monsters who were going to conquer the world.

The procession was due to start at half-past ten, and from a very early hour the route had been lined by vast and excited crowds. Miles of strong palings had been erected along the track, particularly above the deep cuttings, and regiments of soldiers called in to act as special constables and prevent the unruly populace from pushing one another under the wheels. The country gentry were accommodated in grandstands put up along the line, or sat in their carriages to watch, the ladies in bell-shaped skirts, very tight-waisted, with immense leg-of-mutton sleeves and be-ribboned bonnets, the gentlemen in high cravats and tight trousers, with tall chimney-pot hats.

At the given signal, and only ten minutes after time, the procession moved off amid cheers from the passengers and the audience, and the strains of the "Wellington Harmonic Band" which, in its Grecian car at the very head of the procession,

performed " many beautiful miscellaneous pieces ", according to the *Courier*. One suspects that the pieces were rather more miscellaneous than beautiful, as the four-wheeled, springless, bufferless, brakeless " Grecian car " rattled along the line. " Northumbrian " ran on the right-hand line, frequently slackening speed to allow the Duke, Sir Robert Peel, and the other distinguished passengers to inspect some particularly fine piece of work, and then hurrying forward to catch up the other trains which, in their line ahead on the left-hand rail, kept up a steady twenty miles an hour.

From Edgehill station, with its handsome Moorish Arch, the white stone of which was still unstained by smoke, the line passed through the cutting of Olive Mount, which looked, according to one passenger " as though it had been cut out by giants ". The sides of this enormous cutting, as well as the bridges overhead, were thick with people clinging as precariously as flies, who nevertheless managed to free their arms enough to wave their hats and cheer deafeningly as the trains swept by.

The Rainhill Skew Bridge had to be admired, and, as the trains passed at a rattling speed along the level, those who had not been fortunate enough to see the competition the previous autumn had to have all the details recounted for them by their friends. Then up the incline to the village of Sutton, and over the great Sankey viaduct of nine arches, each fifty feet across. The passengers felt like birds as they looked down to the barge-dotted canal and the thousands of upturned faces below. The spectators below craned their necks upwards, and saw the eight trains rippling across the huge bridge. The eight plumes of smoke mingled and became a single banner, fluttering proudly in the September air. The trains rushed past and were gone, rumbling fainter and fainter into the distance.

At Parkside, half-way along the line, there was a stop to take in water. The casks on the tenders carried hundreds of gallons, but they were already running low. The various trains were strung out along half a mile of track, where various temporary watering-stations had been erected, so as to cause as little delay as possible.

There was danger of some confusion, so the passengers had been asked most particularly not to alight, but many of them did so, wandering about between the lines, talking to their friends and admiring the engines. The greater part of the people remained in their seats, their faces pink with excitement and the brisk wind. Their voices rose, and the brass band took new heart and played its selection of popular airs louder and more firmly. There was plenty to talk about during the twenty-minute wait—there had been so much to see that was new, and even familiar things had been made more fascinating by the unusual angle and the unusual speed. They had started from Liverpool less than an hour ago, and were already half-way on their journey. And the things they had seen—tunnels, cuttings, embankments, viaducts—were all unknown until the railway builders built them, and built them so marvellously, too, on a larger scale than could ever have been imagined.

"No fairy-tale was ever half so wonderful," said one young lady, with a sigh of pure pleasure.

But at Parkside occurred the accident that spoilt the whole day. Mr. Huskisson, the Member for Liverpool, was knocked down and fatally injured.

The Prime Minister and he were not on speaking terms, but the friendly atmosphere of the day persuaded Huskisson that it was high time to make up the stupid quarrel, and that if he would make the first gesture of reconciliation it would be accepted. At Parkside he saw his chance.

While the trains were taking in water, he left his place, strolled along the side of the carriage, and walked up to the Duke. They smiled, shook hands, and interchanged a few words—a civility which meant nothing to those who did not know the story, and a great deal to those who did. At the same moment a train was seen to be moving up on the other line, and a cry of "Get in! Get in!" caused several other people to jump quickly into their carriages, or at least to stand well back out of the way, but only flustered Mr. Huskisson, who was impeded by a rather stiff leg.

The two tracks were laid very close together—there was only

four feet between them—and the magnificent state carriage, much larger than any of the others, overhung quite half of this open space. Its door was three feet wide, and therefore, when wide open, overhung the opposite rail, and might be torn off by a passing train.

The engine was approaching quite slowly, and Mr. Huskisson might easily have stepped across the rails to safety. He might

Accident at Parkside

just as easily have stood back against the side of the carriage. Or he might have got into the carriage. But he was nervous. He made two or three attempts to cross the rail, and shrank back each time. Then he made an attempt to get round the open door of the state car, which opened the wrong way for him, and so into the carriage. The whole thing was over, as such things are, before anyone had time to see clearly what had happened.

People shouted. A woman screamed. The engine (it was "Rocket" with young Locke feverishly throwing his weight on to the brake as he saw the danger ahead) hit the swinging carriage door and knocked the poor man down. His right leg was across the rail, and three wheels went over it before the engine could be stopped. When they rescued him from

underneath the tender he muttered " I have met my death ", which was apparently only too true, for his leg was almost cut off.

Someone with a knowledge of first aid put on a tourniquet, and a doctor was speedily found amongst the passengers. The " Northumbrian " was unhitched from its carriages, except for the first one, from which the band were ejected, and which was hastily turned into an ambulance. The injured man was lifted in and with his wife and the doctor taken up the line to the nearest village.

The melancholy news that a distinguished guest had been killed (no one expected him to survive such a terrible wound) flashed round the 800 people there, and the day was darkened. Both the Duke and Sir Robert Peel announced that they were going back immediately to Liverpool, but the directors, although much upset by the accident, pointed out, sensibly enough, that such a course would be a grave mistake. A huge crowd had assembled at Manchester, and if the procession of trains did not arrive, rumour would exaggerate the solitary accident into wholesale disaster, and the new railway would be doomed from its very first day. An official from Manchester, who knew the Mancunians only too well, said gloomily that there would be rioting, and probably bloodshed. The gentlemen were persuaded, and after some delay the procession went on again.

(The author's great-great-great-aunt, a strong-minded woman with an interest in first aid long before Miss Nightingale made it a respectable feminine hobby, was in the directors' car. She was eager to go to Mr. Huskisson's assistance, and believed to the end of her life that his death was solely due to convention in the person of the brother-in-law who prevented her.)

The engineless grand carriage was on the southern line and all the other trains on the northern, and all the crossings had been taken up, but the difficulty was solved by attaching the first two trains together (" Phoenix " and " North Star "), and from them a long chain was fastened obliquely to the Duke's car. It was half-past one before the procession moved off

from Parkside, in a very different frame of mind. " Groups of people continued to cheer us ", said the *Courier* correspondent, " but we could not reply. Our enjoyment was over."

The trains reached Manchester at half-past two. The Duke's carriage was able to enter the town in a more proper fashion than at the end of a long towing-chain, as they met Stephenson on the " Northumbrian ", his sad errand done. He had left the injured man at Eccles Parsonage, which was conveniently near the railway, and had then gone on to Manchester to fetch medical assistance. He could not help adding, pride breaking through, that " Northumbrian " had done the journey at an average speed of thirty-six miles an hour.

From the twenty-fourth mile-post onwards to Manchester the crowd was thick and continuous all the way. Robert, driving the first train, found at the beginning of the three-mile cutting just beyond Chat Moss that the huge crowds had broken through the cordon of perspiring soldiers and swarmed over the tracks. In front of his engine-wheels there was nothing but a sea of people, some cheering, some booing, some waving flags and slogans, and all behaving in as rough and unmannerly a fashion as only a Manchester mob could. The trains necessarily slowed down, and the mob broke up before them and closed in again behind, running beside the engines, jumping on to the carriages, clinging to the door-handles, tumbling off again, pushed by stronger hands. No one was really hurt, however, and the procession reached Manchester in comparatively good order.

But the first fine careless rapture of the day was spent. The guests of honour did not feel like eating the magnificent lunch which had been prepared in the new warehouse, and remained seated in their crimson-and-gold carriage. Some unruly Mancunians brought politics into the day's festivities, waved placards and called the Duke rude names. Stones were thrown, and the atmosphere became uncomfortable. " Northumbrian " took its train home again as soon as it decently could.

But at Eccles four of the seven other engines were taking water, the facilities for watering in Manchester station not being

good. They had left their train-loads of passengers eating lunch, and had run out the five miles or so on the southern line. The hasty departure of the "Northumbrian's" train, and the fact that almost all the crossings had been taken up except at the termini, meant that the four engines had to go in front of the Duke's train almost the whole way to Liverpool before they could cross over to the other line and get back again. The only other course open was for the ducal train to return to Manchester, but the atmosphere of seething unrest, the shouts of "Vote by ballot!" and "No Corn Laws!", which had steadily increased all the afternoon, made that unwise. The Duke was extremely unpopular in Manchester, and although by no means a nervous man, he knew when to retreat in good order.

So the four engines puffed away towards Liverpool, and in Manchester three engines were left to cope with twenty-four carriages and some 500 or 600 passengers. It was getting dark, and the thin cold rain for which Manchester is famous had begun to fall. The twenty-four carriages and the three engines were all fastened together into one long train, which crept homewards in a very different style from the spanking gallop of the outward journey. The rails were thick with mud and gravel kicked up by thousands of feet, and the trains could only proceed, puffing loudly, at a speed of eight miles an hour. Some of the couplings broke, and had to be repaired with rope. On the inclines the gentlemen were asked to get out and walk. At Parkside three more engines met them, and were coupled on in front, and so at last, at ten o'clock at night, in the dark and the rain and bitter cold, the weary passengers were deposited at Crown Street, Liverpool, where a large crowd greeted them with cheers of relief.

Still, in spite of all discomforts, they had seen something, and done something, worth telling to their grandchildren and their great-grandchildren, if they lived so long. They had seen the opening of the Liverpool and Manchester Railway.

From the beginning of normal traffic on the day after the opening, the railway was a success. At first the directors had expected to carry about 200 passengers every day, and they

decided to put on enough trains to carry 400 people, so that there should be no overcrowding. But the first train that left Liverpool carried 140 passengers, and more than 1,000 passengers wanted to use the railway every day.

The railway had not been built with the primary purpose of carrying passenger traffic, but when the passengers arrived, the Company had to provide the trains. People are convenient things for a railway to carry. They are comparatively light, they can be charged comparatively high fares, they find their own way to and from the terminus, and they need no staff to load and unload them. They do not like, however, to be delayed, and cannot be shunted into a siding and made to wait. At first the whole of the Company's little stock of engines was needed to draw passenger trains, and the coal and the cotton and the timber had to take their chance as best they might.

The railway not only carried the normal passenger traffic between the two towns, but it created more and more traffic for itself. Business men could leave home after breakfast, do a day's work thirty miles away, and be back for dinner. It was incredible. It opened up entirely new ways of life and new possibilities for trade. The land which the landowners had fought to keep clear of the contamination of the railway suddenly rose in value because of that same railway. The people who had described in lurid colours how the grass would wither, the cows dry off, the horses take fright, the very birds fall out of the sky, now advertised their land for sale, quoting as an advantage " near to a railway station ". Lord Derby and Lord Sefton promised to patronise a rival line if only it would pass through their estates.

To show what a remarkable change had taken place in the life of South Lancashire, a newspaper related this incident:

> " A gentleman went to Liverpool in the morning, purchased and took back with him to Manchester, 150 tons of cotton which he sold, and afterwards obtained an offer for a similar quantity. He went again, and actually, that same evening, delivered the second quantity in Manchester, having travelled

120 miles in four separate journeys, and delivered, thirty miles off, at two distinct deliveries, 300 tons of goods in about 12 hours. The occurrence is perfectly astounding, and had it been hinted at fifty years ago, would have been deemed impossible."

The price of a single journey at first was seven shillings, soon reduced to four and sixpence—a third of the coach fare—and the time was also reduced from two and a half hours to one and three-quarters, or an average, including stops, of eighteen miles an hour.

The engines which made this remarkable improvement possible were all built in Newcastle. In 1829 Stephenson & Co. had built one engine for the Company—"Rocket". By September 1830—the opening—they had built seven more. A ninth, "Planet", was delivered in October, and a tenth, "Samson", by the beginning of the next year. By the year 1835 there were thirty-two locomotives, all numbered and named, belonging to the Company, but some of the early ones had by that time been completely rebuilt, so rapidly were improvements being made in the design, and the Ericsson engines had been withdrawn.

The ten first engines built by the Stephensons were small by modern standards, but there was a trim efficiency about them that augured well for the future. They had lost the grasshoppery look peculiar to the earlier engines, and were, both in style and performance, recognisably ancestors of the engines we see on our railways to-day.

Each of the ten was an improvement on the one before. Robert and his father consulted together frequently, and found great pleasure and profit in knocking sparks out of each other's brains. Some people, notably the *Mechanic's Magazine*, complained bitterly that the Stephensons had wangled for themselves a monopoly in supplying locomotives, and hinted at bribery, but the fact was that the best engines came from Newcastle, along with the best engineers, and naturally the Company bought them. Robert had at last trained a school of loco-

motive mechanics who possessed the necessary specialised skill. Within a very short time the Stephenson pattern of engine was the only accepted pattern, and all other models were crowded off the roads, not by favouritism, but by sheer efficiency.

At Rainhill "Rocket" had dragged twelve tons weight at twelve miles an hour. She had shown signs of being well within her powers, but the makers were more anxious to establish a reputation for reliability than to indulge in mechanical fireworks. The laying of the track across Chat Moss, shortly afterwards, had been celebrated by the directors and their friends taking a joy-ride, and on that occasion "Rocket" had gone farther and faster, and carried more weight, than she had done at the trial.

The first complete trip between the two towns was done in the June before the opening, and this time "Arrow", the newest arrival from the factory, did the journey in an hour and a half, at an average speed of twenty miles an hour. She did the level stretch across Chat Moss at a speed of twenty-seven miles an hour.

On the opening day "Northumbrian", in an emergency, did the fifteen miles between Parkside and Eccles in twenty-five minutes, or at thirty-six miles an hour. Shortly afterwards "Planet" did the journey between Manchester and Liverpool in one hour. The occasion was the by-election caused by Mr. Huskisson's death, and a cargo of voters were urgently needed at the hustings. Within three months of the opening the trains were scheduled to a speed of eighteen miles an hour, including stops.

But pulling power was even more important than speed. "Planet" took the first load of merchandise from Liverpool to Manchester—eighty tons of cotton, malt, and flour in eighteen wagons—at twelve miles an hour. "Samson's" first run was even more successful. This engine was the first to have its wheels coupled—an improvement that allowed much greater weights to be hauled—and she took a train of 150 tons weight along at twenty miles an hour. All this had been achieved within eighteen months after "Rocket" had astonished everyone by her twelve tons at twelve miles an hour.

CHAPTER IX

THE MIRROR OF RAILWAYS

Railway enthusiasts had been talking about a line between London and Birmingham before the Stockton and Darlington Railway was opened. To link the industrial Midlands—and beyond them, the industrial north—with the capital was one of the first schemes when railway speculation became popular. Preliminary surveys were made as early as 1825, but the slump of 1826 put an end to this as to many other plans, and the idea was lost for a few more years. But when the railway between Liverpool and Manchester was built, and when the Rainhill trial had opened people's eyes to the possibilities of steam locomotion, the idea was mooted again. In 1830 there were plenty of wealthy Lancastrians who were willing to put their money into a railway, even though it did not run through their county, and most of the original promoters were Liverpool and Manchester merchants.

Two companies were formed. One consulted Sir John Rennie, who proposed that the line should go through Oxford and Banbury. The other consulted Mr. Francis Giles, who thought that Northampton and Coventry offered a better route. Sensibly enough, the two companies decided not to fight against each other as well as against a Parliamentary committee. Getting one Bill through Parliament was quite difficult enough, let alone two. Like wise men they amalgamated, and the Lancastrians among them suggested that George Stephenson should be called in to decide on the merits of the two routes. He recommended the Coventry line (which did not make him any more popular with the Rennies). The line would have to cross a number of valleys and the ridges between them. In order to minimise the difficulties, the ridges would have to be crossed as low as possible and the valleys as high as possible,

and the more northerly route through Northampton would make this easier. All their lives the Stephensons were almost fanatical defendants of easy gradients. They would go to any lengths to avoid leading their railways up hills steeper than about 1 in 200. For this reason, they often seemed to indulge in unnecessary and expensive works on their lines—cuttings, viaducts, embankments, and tunnels—the full value of which was not appreciated until many years after their deaths.

A meeting of the promoters of the London and Birmingham Railway was called at Birmingham just after the opening of the Liverpool and Manchester Railway. George Stephenson was asked to survey the line. He would have accepted then and there, but caught Robert's eye, and said instead that he would like to talk it over with his son. They went out of the Library Rooms, where the meeting was being held, into the churchyard opposite, and walked up and down.

George pointed out that it was the finest job he had ever been offered, and he wanted it very badly. He could not see why Robert had sent him that warning look. The directors had named as his associate engineer a man with whom he had already quarrelled over the Liverpool and Manchester Railway. George seemed to think that it would be all right this time, but Robert did not trust his father's tact very far. He was quite confident that George could dictate his own terms, for the directors would not lightly throw away the services of the best railway engineer in the kingdom.

" It must be all or nothing," he told his father as they paced up and down between the tombstones. " Just tell them that. All or nothing."

George did, in some anxiety, but he need not have feared.

" Let it be all," said the chairman without hesitation, and amid a chorus of " Hear, hears ", Stephenson was appointed engineer and Robert was offered the associate post.

As it turned out, George's appointment was merely nominal, as he had more than enough work to do in the north, and it was Robert who made the surveys and, subsequently, was appointed " engineer-in-chief " to build the line.

Before the line could be built the Act had to be passed, and before the Act could even go before Parliament there was much to be done. First, the Company had to advertise their intentions in the *London Gazette* and in the local papers of the counties through which the railway was to pass. Then the engineer had to draw up plans of the line on a scale of four inches to a mile, as well as plans of all the viaducts, tunnels, bridges, stations, and all other buildings. Lastly, the Company had to prove, by means of a subscription list, that people were really ready and willing to invest the money that was needed.

While the surveying was being done, Robert, with his usual thoroughness, walked the whole distance between London and Birmingham twenty times, and he expected his juniors to work as hard as he did. One of them, John Brunton, said:

"We young Engineers led a very rough life. We were obliged to work from daylight to dark as the work was very pressing—and when we started in the morning we did not know where we were to get to, that night."

It was not easy work, for most of the landowners were rabid anti-railwayites, and drove the surveyors off their land by every possible means. In those far-off days of liberty and *laisser-faire*, Parliament did not interfere in such matters. It simply ordained that the plans were to be drawn up and delivered, but gave the planners no help, and turned a blind eye to the difficulties of their situation.

Sometimes the surveying had to be done by night and lantern-light, with one ear cocked for the gamekeepers, and whispered curses and smothered laughs in the darkness as the surveyors fell in and out of bramble bushes and ditches.

There was a certain parson who was very strong against the railway, and his land had to be surveyed during the only hour of the week when he was sure to be out of the way—during the Sunday morning service. By good team-work and no dallying, it was managed, and the survey, started as soon as he was safely in at the church door, was finished before the end of the sermon.

Sometimes Robert visited the crustier old Tories among

the landowners and tried to talk them round. He was patient and courteous, but his arguments were of little use. Seven-eighths of the landowners on the line were dead against all railways in general, and this railway in particular. A few admitted that such things might be very useful in the far north, where conditions were different and the landscape so dreary that nothing could spoil it, but having their own pleasant parks cut in two by the iron road was another matter.

One of the most influential opponents of the railway was a well-known surgeon, Sir Astley Cooper, who lived near Berkhamsted. Robert sent to see him, with one of his assistants.

"Your scheme is preposterous," said the old gentleman. "You are proposing to cut up our estates in all directions for the purpose of making an unnecessary road. Do you think for one moment of the destruction of property involved by it? Why, gentlemen, if this sort of thing be permitted to go on, in a very few years you will destroy the *noblesse*!"

Robert restrained himself until he had left the house, but once outside he fairly snorted with indignation.

"Well, it really is provoking," he said, "to find a man who was made a 'sir' for cutting a wen out of George the Fourth's neck, charging us with contemplating the destruction of the *noblesse* just because we propose to confer upon him the benefits of a railroad!"

In spite of all difficulties, the surveying was finished at last, and the Bill went before Parliament in 1832. Before the Committee, Robert had nearly as gruelling a time as his father had had over the Liverpool Railway. It was bad enough to have his plans criticised, to have his extreme youth emphasised, his lack of experience pointed out by the opposing counsel (so far he had only built two very short stretches of railway by himself—the Warrington Branch, five miles long, and the Leicester and Swannington Railway, sixteen miles long, and at that date not quite finished). But it was bitterly humiliating to have it insinuated that he and his father would manage to get their own locomotives bought by the Company, and everyone else's rejected.

"Are persons to be allowed to draw railway carriages by horses?" asked counsel, with extreme politeness, giving no hint of the direction in which he was tending.

"I think that is quite impossible on a line where locomotive engines are used," answered Robert.

"All the engines are to be approved by the Company?"

"Yes."

"The engines are not to be exclusively furnished by the Company?"

"No."

"Are you and your father great manufacturers of steam-engines?"

"We do manufacture them."

"For this railroad, do you not, and for others?"

"For any railroad."

"You are the persons who are to be applied to?"

"I do not know. For the time being I am only the engineer."

"As long as you and your father are the engineers, you are the people to decide what engines shall be used by other people?"

"If there is any fear of our giving prejudiced opinions, the committee can easily call in other engineers to decide the point."

"The engines to be used are to be approved of by the engineer of the railroad Company; and there is no appeal from this decision, if he says he does not like the engines?"

"I may not be the engineer for the Company. I may be done with the railroad as soon as it is completed, if I am there so long. I may not be the resident engineer."

Although he carried it off with dignity and apparent calm, Robert was not yet hardened to this sort of thing, and it made him miserable. He did not go to bed during the four days of his cross-examination, but worked round the clock, sleeping for a little in a chair and setting to work again. By the time the inquiry was finished he was dead tired as well as worried and overwrought, and when the decision went against him, and the Bill was thrown out, it was almost more than he could stand. He was escaping as quickly as possible from the committee room when the chairman of the Committee, Lord Wharncliffe,

one of the Northumbrian " Grand Allies ", and a friend of his father's, stopped him.

" My young friend," he said very kindly, " don't take this to heart. The decision is against you; but you have made such a display of power that your fortune is made for life."

The Bill was passed in the next session, the landowners having been " conciliated ", as the Company tactfully expressed it, to the tune of half a million pounds. The Act was granted the Royal Assent in May 1833, and in the following September, after some months of anxious waiting, Robert was offered the post of engineer-in-chief and in effect the chance to make his name and his fortune. The line was going to take at least three years to build, and during that time he was not allowed, under the terms of his contract, to be the engineer to any other railway, so that if the London and Birmingham Railway succeeded he would be judged on its success, and if it failed he would be condemned on its failure. He left his house in Newcastle, and with his wife settled on Haverstock Hill, London, conveniently near to the London end of the works.

The actual building operations were to be begun as soon as possible, but first the various parts of the line had to be let out to contractors, and for this purpose drawings of all the sections of the line had to be made, and copied and re-copied. Like every other part of railway-building in those days, it was all done at top speed and under terrific pressure. One of Robert's sub-assistant engineers on District No. 5 between Kilsby and Birmingham, wrote a graphic description of what the work was like.

Like so many of the younger generation of railway engineers, John Brunton came from an engineering family. His father was one of the first members of the Institute of Civil Engineers, and little John had stood beside the great Mr. Telford's knee at one of their first meetings. He had then and there determined to be an engineer, and had never changed his mind, although with the coming of the railways he had shifted his allegiance from Telford to the Stephensons.

At eleven years old he was learning to use a level through the streets of Islington near his father's house.

At sixteen he was an apprentice in Cornwall, and got his practical mechanical experience in the workshops, working from six in the morning till six at night.

At eighteen he was sent to Wales to do a job for his father, who could not leave London—laying out a tramway in the mountains in sole charge of 500 workmen without a word of English between them.

At nineteen he was offered a job on the London and Birmingham Railway by Robert, who thankfully offered him an extra £50 a year because he had at least worked for a few months on a mountain tramway, while none of the other assistants had any practical experience at all.

"I was ordered up to London [said John Brunton in the story he wrote for his grandchildren] to take charge of the designing of the necessary Bridge Drawings and other contract plans for the letting of the work to contractors. The Railway Company took the Eyre Arms Tavern, at St. John's Wood as an Engineers drawing office. The Tavern at that time being unoccupied. The Ball Room formed the Drawing Office. Twenty draughtsmen by day & the same number at night formed the corps I had to superintend, of course under the occasional inspection of my chief District Engineer Mr T. Longridge Gooch.

"All the contract drawings had to be ready by a certain day—about a fortnight after the day we commenced the work upon them.

"It was a tight pinch, for my draughtsmen then were not much used to this class of work.

"But we struggled on—I, very anxious that this, my first important charge should not be behind time, kept at my post night and day with one night only in bed for the fortnight.

"This was foolish, as I found out afterwards, but I was full of energy and determination.

"One by one my staff dropped off quite overcome with

the incessant work I called for, but at last the work was accomplished on the evening before the Contract Plans & Specifications were due in Birmingham.

" I had looked them all over—put them all into their special portfolios—and was waiting for the arrival of Gooch with someone, who was to take them in charge and convey them to Birmingham by the night *Mail Coach*. (Recollect there were only 2 railways in existence then, The Liverpool & Manchester and the Stockton and Darlington.) Every thing being ready I went down to the Entrance and sent for a cab to take me to Edmonton, where my dear Father and Mother were then living.

" At that moment I met Mr George Stephenson and Mr Gooch. The latter hailed me: ' Halloo Brunton, I can find nobody to take these plans down to Birm^m^ to-night, so you must take them '.

" I made some slight remonstrance on the head of the work I had gone thro' for a fortnight. But no one else could be found, so the cab which I had hired, with anticipation that it would carry me to a good bed & sleep that night, was loaded with the packages of plans and directed to take me to the *Swan with Two Necks*, Lad Lane, whence the Mail Coach for Birmingham started at half-past eight. I found all full inside and only one of the four outside places left for poor me. I booked for Birm^m^, saw my packages safe in the boot of the coach, and got the middle seat of the three behind the coachman. I drew my plaid round my head leaned back against the luggage on the roof and was fast asleep before the coach left the yard. Nor did I awake until 11½ hours afterwards, I was roughly shaken and told I was at the *Hen & Chickens* Hotel, Birmingham ! "

When John Brunton reached his lodgings after depositing his plans, reaction threw him into a fever. For three weeks he lay in a kind of stupor, but recovered with the resilience of youth under his sister's good nursing, and was back at work on the railway within the month.

Work on the line was started in 1834, and it was hoped to open it in 1837, but, owing to a very wet winter and many unforeseen delays, it was actually opened in 1838.

As engineer-in-chief, Robert had taken on a task before which many men might have hesitated. Although he was only twenty-nine, he had inherited more than enough of his father's qualities to take it on without a backward thought. He had the doggedness and the tenacity, although he lacked a good deal of his father's self-confidence and almost all his obstinacy. Before the London and Birmingham Railway had engaged him, but when his name was already being quoted a good deal as that of a promising young engineer, a friend congratulated him on his rising fortunes. Robert looked at him very seriously.

"My courage at times almost fails me," he said. "I am afraid that some fine morning my reputation will break under me like an eggshell."

But his courage never quite failed him once he had undertaken something. His gentle, rather solemn expression covered a brain as brilliant as his father's, and he had a capacity for work which he had inherited and which was almost phenomenal. South America had cured him of a tendency to consumption, but he was never really strong in health, although in physique and endurance he was as tough as his job demanded. He was quieter, gentler, more conventional than George—which was only to be expected from the difference in their upbringing—but he had the same intellectual power, the same thoroughness, and, like his father, he had the gift of inspiring every last man who worked for him to enormous efforts and a feeling of personal pride and responsibility in the work. George was always "Old George" to everyone who worked for him. Robert was "the Chief". Historically, he has been overshadowed by the more romantic career of his father, and he did everything he could to deepen the shadow.

"It was his thorough training," he used to say, "his example, and his character, which made me the man I am." And he never lost an opportunity, in public or private, of passing on the glory to his adored father.

In this he succeeded so well that many people, passing Euston Station, wonder why it should be *Robert* Stephenson whose statue stands at the entrance, looking down at the streams of traffic passing in and out of the terminus.

The building of the London and Birmingham Railway was stiff going. The railway was to be 112 miles long, from a place on the northern outskirts of London called Euston Grove (Robert wanted the directors to make their terminus boldly at Charing Cross, but they would not listen to him) to Curzon Street, Birmingham. Very heavy works were needed on the line—eight tunnels and as many viaducts, miles of embankments, and magnificent cuttings like wild-western canyons. The contractors who undertook to build the various stretches of line knew next to nothing of railway-building, and seven of them at various times cried off and threw in their contracts. In each case the young engineer, unperturbed, undertook to manage those stretches personally on behalf of the Company. Other contractors loyally finished their work, although they lost money heavily. Some, regrettably, tried to make up for their losses by under-paying and swindling the hordes of sturdy navvies who worked for them.

The tunnels on the line excited most public interest. Up to that time the only tunnel for passenger traffic was the Edgehill tunnel at Liverpool, but the people of London had never seen it. There were to be no fewer than eight on the Birmingham line, the average length a mile each. What was going to be the effect of all this underground travelling in air made unpleasant, possibly harmful, by the smoke of coke-burning engines? Would it be possible to ventilate them properly? Would there not be an enormous increase in coughs and colds and all sorts of pulmonary diseases? These were the questions which were being discussed.

> "The deafening peal of thunder [said a medical journal], the sudden immersion in gloom, and the clash of reverberated sounds in a combined space, combine to produce a momentary shudder, or idea of destruction, a thrill of annihilation."

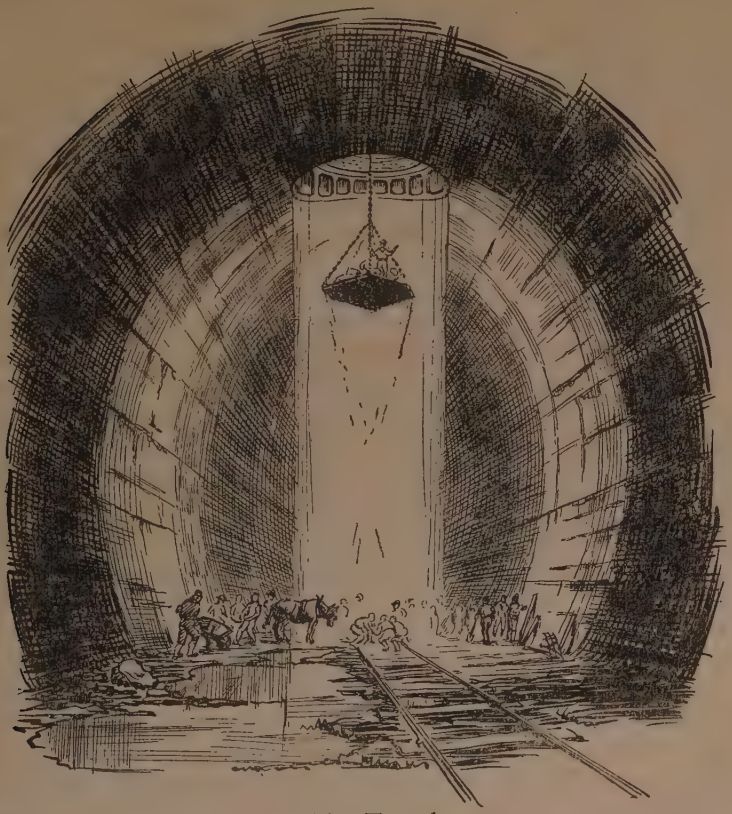
There was so much adverse comment that the Company thought it as well to ask a committee of doctors and surveyors to visit the Primrose Hill Tunnel while it was being built and publish their findings. Their report, although it erred distinctly on the optimistic side, at least had a reassuring effect on the public.

> "We found the atmosphere of the tunnel dry [they said], and of an agreeable temperature, and free from smell; the lamps of the carriages were lighted, and in our transit inwards and back again to the mouth of the tunnel the sensation experienced was precisely that of travelling in a coach by night between the walls of a narrow street; the noise did not prevent easy conversation, nor appear to be much greater in the tunnel than in the open air. . . . The apprehensions which have been expressed, that such tunnels are likely to prove detrimental to the health, or inconvenient to the feelings of those who may go through them, are perfectly futile and groundless."

This tunnel at Primrose Hill was one of the very difficult works which were returned on the Company's hands, the weight of the clay above crushing in the brickwork of the tunnel before the mortar had time to set. An even more difficult task was the Kilsby Tunnel.

The line should have passed through the town of Northampton, as originally planned, but the citizens refused to have anything to do with the horrid thing, and Robert was obliged to take his line five miles to the west, straight through the Kilsby ridge. The tunnel which had to be bored was a mile and a half in length and in places 160 feet below the surface. Trial shafts were sunk to ascertain the nature of the rock, and the tunnelling began. Then it was found that the way was barred by a huge underground quicksand. Water was held in the sand because it could not pass through the clay below, and the mass was as liquid as water, but far more dangerous. The trial shafts must just have missed the edge of this sand, which stretched for a quarter of a mile in each direction. The con-

tractor, faced with this calamity, took to his bed, a broken man, and although the Company released him from his contract, he died from worry and nervous exhaustion.



Kilsby Tunnel

It looked as though the tunnel would have to be abandoned, and several eminent engineers gave it as their considered opinion that the task was impossible. Robert volunteered to take full responsibility. Perhaps he was thinking of Chat Moss, and made up his mind that sheer doggedness could conquer anything.

The tunnel had been begun not from the ends, but in the middle, by means of two huge shafts, which were to remain as ventilation shafts. Above these Robert built pumping-engines to try to keep the water down while the shafts were sunk a few feet at a time, and bricked in by walls of enormous strength. The problems which faced him were not strange to a mining engineer, and he felt quite confident, which was more than the Company did, for they sent their secretary along to see the young engineer and suggest as tactfully as possible that they would like some other engineers to be consulted. The pumps were at work night and day, but the water had none the less risen almost to the top of the ventilating shafts, and there appeared to be good grounds for the Company's anxiety.

But Robert knew his own ability, and trusted the pluck and loyalty of his workmen, and he begged for a fortnight's grace.

"Tell the directors not to be frightened," he said, "and say that all I ask is time and fair play. If I can't get rid of the water, then I'll think about going to other engineers for help."

The secretary went away an enthusiastic supporter of the self-possessed young engineer, and told the directors, on his own authority, that they need worry no more. Robert haunted the works day and night, watching the pumps at work, watching the level of the water. At last it began to subside by millimetres. It went down two inches in a week. The engines pumped without ceasing for eight months to keep the water down, and at last the men could get to work on the tunnel itself.

The troubles were not yet over for one day in the winter a navvy's pickaxe tapped a hidden reservoir of water, which came pouring like a cataract into an unfinished part of the tunnel. There were no pumps in this stretch to keep it under, and the only thing to do was to try to complete the tunnel wall with bricks before it was quite filled with water. The men were floated to their work on a raft, with bricks and cement, and still the water poured in. As they worked on the walls to seal off the water, the raft floated higher and higher towards the roof. The wall was nearly finished, and the men's heads were against the roof. A few more courses of bricks, and they were forced to

kneel. As the last bricks went in they were in the greatest danger of being crushed. The young assistant engineer wriggled over the edge of the raft, and, taking a rope in his mouth, towed the raft and the men to the bottom of the ventilating shaft, which they reached just in time, and were hauled bodily up to the surface.

Kilsby tunnel occupied 1,200 men for two and a half years, and cost £350,000. Twelve million bricks were used on it, among other materials. And within a year or two the inhabitants of Northampton were clamouring for a branch line to share in the benefits of the railway.

The railway was at first to end at Camden Town, but a supplementary Act gave permission to take it to Euston Square. This meant a deep and wide cutting through the houses and streets of Camden Town, and this great work attracted large crowds of curious Cockneys, who used to stroll along in their free hours to see how it was progressing. Among others was a young newspaper man aged twenty-four, who afterwards wrote a vivid description of the railway, which he put into a book called " Dombey and Son ".

" The first shock of a great earthquake had, just at that period, rent the whole neighbourhood to its centre. Traces of its course were visible on every side. Houses were knocked down; streets broken through and stopped; deep pits and trenches dug in the ground; enormous heaps of earth and clay thrown up; buildings that were undermined and shaking propped by great beams of wood. Here, a chaos of carts, overthrown and jumbled together, lay topsy-turvy at the bottom of a steep, unnatural hill; there, confused treasures of iron soaked and rusted in something that had accidentally become a pond. Everywhere there were bridges that led nowhere; thoroughfares that were wholly impassable; Babel towers of chimneys, wanting half their height; temporary wooden houses and enclosures, in the most unlikely situations; carcasses of ragged tenements, and fragments of unfinished walls and arches, and piles of scaffolding,

and wildernesses of bricks, and giant forms of cranes, and tripods straddling above nothing. There were a hundred thousand shapes and substances of incompleteness, wildly mingled out of their places, upside down, burrowing in the earth, aspiring in the air, mouldering in the water, and unintelligible as any dream. Hot springs and fiery eruptions, the usual attendants upon earthquakes, lent their contributions of confusion to the scene. Boiling water hissed and heaved within dilapidated walls, whence, also, the glare and roar of flames came issuing forth; and mounds of ashes blocked up rights of way, and wholly changed the law and custom of the neighbourhood.

"In short, the yet unfinished and unopened railroad was in progress; and, from the core of all this dire disorder, trailed smoothly away upon its mighty course of civilisation and improvement."

Charles Dickens was not the only person who saw the railway in this romantic and heroic light. So did many other people, not least among them being the engineer. One has only to look at the magnificent gateway to it which he erected in Euston Square.

The railway station was at that time on the fringes of London, and when the great portico was first built one could see through the pillars the green hills of Hampstead, and really feel that one was looking through the gateway to all England. Thirty-five thousand pounds was spent on the entrance alone. The huge portico with its Doric pillars built apparently to stand to all eternity, the wrought-iron gates, the finely spaced buildings, were suitably approached by an open drive, although they are now masked by a jumble of bricks and mortar. Robert and his contemporaries really felt, as one of them put it, "that the national character was involved in the whole".

As soon as it was opened, the railway was described minutely by a spate of enthusiastic guide-books.

"The impression on the eye [said one of them], and still more on the mind, on approaching the works by the Grand Entrance, through a spacious area—the first view of the road

—the vast preparations—the splendid train of carriages, presently sweeping along with the velocity of the wind—is described by almost every stranger as at once exciting and magnificent. . . .

" From Euston Square to Camden Town the Railway is formed by a wide cutting or trench, about eighteen or twenty feet deep, the sides of which are composed of beautifully executed brickwork, having an iron balustrade at the top which, when the trees and shrubs of the adjoining gardens have sprung up, will form a pleasing object . . .

Euston Station

" The train is usually drawn up this length of rail in three or four minutes, during which time the passenger passes under several very handsome stone and iron bridges and galleries."

This and other guides are written entirely in the language of æsthetic appreciation, and abound with such phrases as " this elegant suspension bridge ", " this magnificent structure ", " a remarkably picturesque appearance ", and so on—phrases which strike oddly on the twentieth-century mind, which has somehow agreed to turn a blind eye to railway architecture, and can admire a picturesque valley without apparently being aware of the railway viaduct that spans it.

The Euston Square station, which was awarded unstinted praise by all the early guide-books, was particularly pleasant during the first six years of its existence. Owing to the steep gradient from the station to Camden Town, there were no locomotives on this stretch until 1844, and the handsome white stone was unstained by soot or smoke. The locomotives were unhitched at the Camden Town Depot (which was also the goods-station), and the trains were hauled in and out of Euston by an endless rope worked by stationary steam-engines.

The railway, which soon earned for itself the name of " the mirror of railways " because it was so admirable in every respect, was opened on September 15th, 1838. The years of its building had been busy ones all over the country, and, among many other less important lines, the Grand Junction Railway between Birmingham and the Liverpool and Manchester Railway had been completed in 1837, so that the opening of the London and Birmingham Railway saw the opening of communication by rail between London and the north of England.

The opening was a triumph for Robert Stephenson, but as he drove the first train from London to Birmingham, taking the directors to a modest dinner-party in the latter town (there was none of the flamboyance that marked the opening of the Liverpool and Manchester), he could not feel particularly elated. For four years the railway had been his life, and he could not leave it without regret.

CHAPTER X

THE RAILWAY BUILDERS

WHILE he was building the London and Birmingham Railway, Robert Stephenson was not allowed by his contract to engineer any other, but that did not stop all the projectors, planners, and engineers coming to ask his advice. He felt at last that it was hardly fair to his employers to use their office at Camden Town for receiving this constant stream of visitors, and he decided to take an office of his own. His father, too, although most of his engineering work was in the north, needed a London office conveniently near to the Houses of Parliament, so in 1837 they took an office in Great George Street, almost in the shadow of Big Ben.

The years during which the London and Birmingham Railway was being built were very busy ones. A real effort was being made to forge railway links between the chief centres of population in England. The busiest year, 1836, saw the sanctioning of lines between London and the West Country, London and Southampton, London and Dover, London and East Anglia, London and Cambridge. The great trunk line which was to link north and south via Birmingham was already taking shape in its two separate parts, and a whole network of railways was projected in the north and the Midlands to take in all the chief industrial towns—Liverpool, Manchester, Preston, Bolton, Leeds, York, Hull, Sheffield, Derby, Nottingham and Leicester. The boom of 1836 collapsed in a slump, as had the smaller boom of 1826, and as would also the much greater boom of 1846, but before the slump came, the skeleton of a fine railway system had been laid out on the map of England. Railway Acts were not yet very easy to obtain, which was all to the good. Only the best plans were sanctioned. It was a period of sound building on good principles, quite unlike

the " mania " of ten years later, and to a very large extent the Stephensons are to be thanked for this. George's sphere of influence was the north, Robert's the south, and their importance grew at a speed which astonished themselves.

Rainhill was only a very few years behind, but success breeds success so rapidly that Old George now found himself one of the most famous engineers in the world, specially invited to Belgium by the King, and royally entertained to private audiences and public banquets.

In the three years from 1834 to 1837—the busiest of his life—George travelled more than 20,000 miles by post-chaise, apart from many journeys by rail, coach, horseback, and his own long legs—he was always a prodigious walker. At the same time, out of these three years he spent six whole months in London attending to his Parliamentary work. During one session, Parliament authorised five new railways of his surveying—from Derby to Leeds, Normanton to York, Manchester to Leeds, Birmingham to Derby, and Sheffield to Rotherham. There was only one scheme in the north from which his name was conspicuously absent. He had quarrelled bitterly with Joseph Locke, who had been his pupil, was now a very able engineer on his own account, and would be reckoned at the time of his death one of the three greatest engineers in the kingdom, Robert Stephenson and the younger Brunel being the other two. Locke was given the post of engineer to the Grand Junction Railway over the head of his old master, and in a fit of obstinate bad temper Stephenson did all he could to encourage a rival line, the Manchester and Birmingham. This quarrel was unhappily never made up, for it was the defect of Old George's great qualities that he could be bitterly obstinate and found it very hard to forgive those who he thought had wronged him.

He was frequently called in to give evidence in support of other lines which he had not engineered. His was the most influential voice in the railway world, and everybody knew his absolute reliability. He was not always right, although more often than not in matters of railway engineering. But he would

never move an inch unless he *thought* he was right, and as the principles on which he worked, as well as his few foibles, were well known, he was as dependable as the Rock of Gibraltar.

He had the constitution of an ox, and he needed it. Many and many a night he spent fast asleep in the corner of a post-chaise between two full days' work. He was the kindest and most charming of employers, but he wore out the succession of young engineers who acted as his secretary. As he never touched a pen except to sign his name, he had to dictate all his letters—and they were many—sometimes in a chaise, sometimes in the evening at whatever inn they happened to lodge, sometimes in his study at home on the rare occasions when he spent two or three days there. On one occasion he dictated thirty-seven letters and reports without stopping, and they were long letters too, full of solid, closely reasoned argument. He had the illiterate man's colossal memory, and had trained himself to be a first-class dictator, even though it was beyond his powers to train himself to be a good scribe. On another occasion he kept his secretary at work for twelve hours on end, until the young man, nearly dropping off his chair with weariness, begged for mercy. No one was more kind-hearted than Old George, or more solicitous for other people's welfare, but he was never tired himself, and he forgot that other people might be. He had been trained in too hard a school to find a few thousand miles in a post-chaise, or a week's work of seven full days, fatiguing, and sometimes, thinking of the time when he used, between a day's work at the engine-house and an evening's work at his studies, to spend a few hours flinging ballast out of a ship's hold, he would shake his head and say "Ah, you young lads don't know what work is."

Sometimes for a month at a time he was constantly on the move, without even a Sunday at home, travelling, surveying, visiting, attending meetings and conferences, journeying every day and often every night, never without one or two or three appointments in the twenty-four hours, sometimes at places 100 miles apart. He spent his life so that other people should

travel more easily, but there is no sign that lack of railways ever kept *him* at home.

There was never a man who knew the roads of the north of England better than he did. He had such an excellent eye for country and such sharp observation that he could roughly map out the whole course of a railway from a post-chaise, and when it came to the more accurate surveying he was rarely found to have been wrong. But it was not only railways that were in his mind. He noticed everything—houses, farms, cattle, crops, and people.

"The fact is," he said once at a grand railway luncheon, "I'm going to end my days as a farmer."

Stories, not always authentic, gathered round the name of "Old George", as they do round any character. The best and most typical of the true ones was told by John Brunton, who, after his work on the London and Birmingham Railway, went to the Manchester and Leeds as an assistant engineer.

"Mr George Stephenson came down and as was his custom took one of the Engineers with him to act as his Secretary during a journey through the District traversed by the Railway.

"We were at Wakefield in Yorkshire one day, when Mr Stephenson called me and said, 'Brunton order a chaise quick, we must be in Manchester in time for me to catch the train to Liverpool this evening.'

"I looked at my watch and saw that to do this, there was not a minute to spare; I had the chaise at the door sharp and Mr. Stephenson & I jumped in, with injunctions to the post-boy to drive fast. On we went and when approaching the toll-bar at Littleborough, I sat with a shilling in my hand to pay the toll without losing time. The chaise pulled up and from the toll house came out a man with leather apron on and a last in his hand. Mr S. seeing him called out 'Halloo, ye are a shoemaker are ye.' Ay said the man. Quoth Mr S. 'do ye ken how to mak cobbler's wax?' No Sir, says the man I generally buys it. 'What! you a shoe-

maker and dinna ken hoo to mak cobbler's wax! Open the door. Open the door.' But, Mr Stephenson said I we have no time to spare we shall miss the Train. Man! said he, here's a shoemaker doesna ken hoo to mak Cobbler's wax.

"With that he entered the toll-house, and with a pot over the fire he showed the wondering cobbler how to make cobbler's wax.

"Of course we missed the train, and all the way from Littleboro' to Manchester I was treated to a most interesting lecture, upon the advantage to every man to be self reliant and in business of every kind to make himself master of every step or stage in such a business."

One wonders if Brunton, with his curious punctuation, ever made a very good secretary, but he certainly knew how to catch the tone of a person's voice on paper.

His work as a civil engineer was not Stephenson's only interest during these busy years. There was also the factory at Newcastle, which was flourishing to such an extent that it now employed more than 800 men, and its products were known all over the world. There was his colliery in Leicestershire as well. In 1831, when Robert was surveying his first real railway —the Leicester and Swannington—he wrote to his father informing him that a small estate at Snibston was for sale, and that, so far as he could tell, there was coal under it in large quantities. It was always a pet wish of George's to see the railways improve the coal trade of the country, and here was a chance for him to work out his own theory. With two partners from Liverpool, he bought the estate, and a small house called Alton Grange, where he lived (or rather, passed occasional nights and days between more pressing engagements) for the next eight years.

The coal was there, although it was buried so deep under layers of very hard volcanic rock that even George Stephenson nearly despaired. At last they reached the seams, which were as rich as Robert had predicted. By the time the first coal was ready to be marketed the railway was finished, and the busy

town of Leicester, fifteen miles away, was a ready-made market. Up to that time coal had been brought to Leicester by canal from Derbyshire, but the supply from fields near at hand by rail sent the price down to eight shillings a ton, and saved the inhabitants something like £40,000 a year. Stephenson's colliery, among others, prospered very much.

It is often said that there is no master so hard as a self-made man, but one of the nicest things about George Stephenson's particularly nice character was his care for his workpeople. At Snibston he built good, sound cottages for his men, and saw to it that each had a piece of garden. He not only built a church and a school, but a Methodist chapel and schoolhouse as well. He was always eager to help people, but he had no desire to dictate terms. It was no wonder that his men loved him and worked well for him.

In 1840 George Stephenson publicly announced that he intended to retire. It was only eleven years since Rainhill, but they had been years so crowded that they had included a lifetime's work. Although the successful part of his career had been so short, he was almost sixty, and he felt that he would like to spend the rest of his days in comparative peace.

While his father was thus considering retirement, satisfied with his work and his comfortable savings, Robert was in serious trouble. In spite of the fact that since the opening of the London and Birmingham Railway his professional income was some thousands a year, and increasing all the time, he was very near to bankruptcy. This uncomfortable state of affairs dated back for some years, although Robert had been blissfully unaware of it.

Before he worked on the London and Birmingham Railway he had been consulted as engineer by the Stanhope and Tyne, an insignificant Northumbrian coal-line which paid him the handsome fee of £1,000. Robert made no objection when the money was paid in ten shares of £100 each in the railway. It seemed to him that the line would prosper and pay a good dividend, and he was glad to have a share in it. The railway, however, was badly directed and badly run from the beginning.

There were some rather shady goings-on in the background. The directors undertook to pay such large sums for "wayleaves" that they soon found a financial millstone round their necks. By 1838 the company was in a dreadful muddle of debts. It could not find the money to complete the line, and, if the line were not completed, it could not make any money to clear up its debts. The whole was a vicious circle. Robert paid no attention. He held £1,000 of worthless stock, which, though annoying, was no more, for he was on the way to becoming a wealthy man. But, to his horror, he suddenly found that the Company in which he held these shares was so peculiarly constituted that liability was not limited—that is, that each shareholder was responsible for the debts of the entire Company, and that he, as a prosperous man, was likely to have every penny of his property swallowed up to pay debts that were none of his making.

When he found out his position, he and other shareholders threw themselves into the work of trying to put the Company on its feet before it went bankrupt and brought them all down in its fall.

> "The history of the Stanhope and Tyne is most instructive [he wrote bitterly to a friend when the difficulties were at their height] and one miss of this kind ought to be, as it shall be, a lesson deeply stamped. If the matter gets through, I promise you I shall never be similarly placed again."

To get the struggling Company back on its feet he had to raise every penny that he could, even to the extent of transferring part of his share in the factory to his father.

> "The fact is [he wrote to the general manager of the factory], I owe him nearly £4,000, and I have not now the means of paying him as I expected I should have a month or two ago. All my available means must now be applied to the Stanhope and Tyne. On the 15th of this month I have £5,000 to pay into their coffers. The swamping of all my labours for years past does not now press heavily on my

mind. It did so for a few days, but now I feel master of myself; and though I may become poor in purse, I shall still have a treasure of satisfaction amongst friends who have been friends in my prosperity."

The Stanhope and Tyne Company staggered to its feet and, under another name, lived to be a flourishing and prosperous concern. Robert never forgot his lesson, and never again accepted shares in a company by way of a fee. He built railways, but as a rule he did not invest in them. He preferred to have his eggs in more than one basket.

The next year brought worse trouble. His dear wife Fanny died. They had been married only fourteen years, and had had no children. He felt very much alone, and threw himself into his work even more whole-heartedly than before. Although he had many friends, the only two people he really loved were his father and Fanny. His notebook shows how he turned to his work to smother his sorrow.

"Oct. 11th. Funeral of my beloved wife.
Oct. 12th. Home—Stockton and Darlington Bridge.
Oct. 13th. Stockton Bridge, plans and specifications—West London, estimate and plans—French Railway Report with Berkley—Maidstone Branch.
Oct. 14th. Maidstone Branch with Bidder—Norwich plans—Newcastle and Darlington plans—French Railway Report."

And so on, without a day's break, for week after week.

Stephenson was not the only engineer who worked at this tremendous pace.

"You have no idea how we were driven to get our plans ready for lodging at Preston before November 30 [wrote Charles Vignoles to a friend. He was a contemporary of Robert's and had worked on the L. & M.R. under George Rennie in 1825.] The hurry and anxiety were five times

greater than with the Liverpool and Manchester line. For three nights none of us went to bed, and when all was finished every one was completely knocked up. I have, however, accomplished my task; but it has left me full of nervousness, and I am reduced to a skeleton. The worst is, that I can see no end to it, for the public estimation and enthusiasm for new railroads and locomotives is daily augmenting."

Vignoles was quite right in supposing that the engineers' work would become more instead of less pressing. November 30th was the deadline for lodging plans which were to go through Parliament that session, so that the months of October and November were always a nightmare in the engineering offices.

In his diary, a few years later, Vignoles said that for a week before that date "some of us were engaged incessantly on the plans and sections for twenty-four hours at a time. Indeed, for several nights not one of my staff went to bed. Many of them were completely knocked up. My son Hutton, twenty-one years of age, on the last night of our work fell into a profound sleep with all his clothes on; and, as he could not be awakened, they cut off his Wellington boots, and rolled him into bed just as he was!"

It was an era of Homeric achievements, as exciting as any in our history, and unaccountably neglected by producers of film epics. The corresponding era in America has already become a legend. It is a pity that no one on this side of the Atlantic has yet seen the cinematic possibilities of the Early Steam Age.

The men as well as the masters were built of heroic stuff. The "navvies"—so called because they were the lineal descendants of the "navigators" who built the canals—were a race apart, hard-drinking, hard-swearing, rough, tough men, with few morals and no manners, but capable of enormous efforts. To the Victorians honest hard work covered a multitude of sins, so that the navvies are described in many books with sympathy and even respect.

"The navvy wandered about from one public work to another—apparently belonging to no country and having no home. He usually wore a white felt hat with the brim turned up, a velveteen or jean square-tailed coat, a scarlet plush waistcoat with little black spots, and a bright-coloured kerchief round his Herculean neck, when, as often happened, it was not left entirely bare. His corduroy breeches were retained in position by a leathern strap round the waist, and

Navvies at Work

were tied and buttoned at the knee, displaying beneath a solid calf and foot encased in strong high-laced boots. Joining together in a 'butty gang', some ten or twelve of these men would take a contract to cut out and remove so much 'dirt'—as they denominated earth-cutting—fixing their price according to the character of the 'stuff', and the distance to which it had to be wheeled or tipped. The contract taken, every man put himself on his mettle; if any was found skulking, or not putting forth his full working powers, he was ejected from the gang. Their powers of endurance were extraordinary. In times of emergency they would

work for 12 and even 16 hours, with only short intervals for meals. The quantity of flesh-meat which they consumed was something enormous; but it was to their bones and muscles what coke is to the locomotive—the means of keeping up the steam. They displayed great pluck, and seemed to disregard peril. Indeed the most dangerous sort of labour—such as working horse-barrow runs, in which accidents are of constant occurrence—has always been most in request amongst them, the danger seeming to be one of its chief recommendations."

The horse-barrow runs here mentioned were the only means then known of digging out a cutting. Mechanical aids to excavation there were none. It was not until 1845 that steam power was even used for pile-driving. Until that date the piles for bridges were driven by a mediæval arrangement which hauled a weight to the top of a frame and then dropped it on the head of the pile. The operation was slow and uneconomical.

This new world of railway engineering, having no technique of its own, had at first to borrow from the world of agriculture. All the great trunk lines, with their viaducts and tunnels, cuttings and embankments, were built with hardly more elaborate tools than those which a farmer uses to dig a ditch or build a pig-sty.

The navvies' chief tools were pick-and-shovel and wooden barrow. These barrows, specially built, were capable of carrying 3 or 4 cwt. of earth and stones—a pile over which the man could barely see the narrow plank on which he walked. When English engineers and English contractors were engaged (as they often were) to build foreign railways, they took their English navvies with them, for the foreigners stood amazed at the mere sight of the English barrows, and struck work if they were asked to use them.

The horse-barrow run was a device for getting the barrows of earth out of the bottom of the cutting. Bourne's *London and Birmingham Railway* describes how it was worked.

"The horse in moving along the top of the embankment, draws the rope attached to a wheelbarrow round two pulleys, and thereby raises the barrow of earth up the sloping board, together with the labourer who holds and guides it. This is a dangerous occupation, for the man rather hangs to, than supports, the barrow, which is rendered unmanageable by the least irregularity in the horse's motion. If he finds himself unable to govern it, he endeavours, by a sudden jerk, to raise himself erect, then throwing the barrow over one side of the board, or 'run', he swings himself round and runs down the other. Should both fall on the same side, his best speed is necessary to escape the barrow which, with its contents, comes bounding down after him."

Accidents were frequent, needless to say. On the London and Birmingham Railway, Robert Stephenson invented a kind of lift—a movable horse-drawn platform—to do this dangerous work, but the navvies resented this attempt to deprive them of a job, and contrived to break the contraption.

Osborne's *London and Birmingham Railway Guide* relates another instance of the recklessness with which these men regarded danger. While the Blisworth cutting was being made, the stone quarried out was carried down the line to construct an embankment. The navvies were in the habit of riding down to their dinner on these trucks, with calamitous results if the trucks overturned, which they did not infrequently, the line being only temporary and none too safe.

"A few days prior, a severe accident, accompanied with loss of life, had occurred in this place; yet, nothing daunted, the men, instead of walking to their dinner, came riding down on the trains. A similar catastrophe was the result; several wagons were thrown off the rails; one man was completely buried under the masses of limestone, and several partly so. One stalwart navigator disencumbered himself from the heap, and feeling his arm, said, addressing a more fortunate comrade: 'It's broke, by God! I mun go home.' He

waited for a short time to ascertain the amount of evil inflicted on his fellow-sufferers, and then supporting his broken arm with his sound one, accompanied by a friend, strode off homewards; his cottage was six miles off! A fine, handsome youth, who had his foot pulverized into a shapeless mass of flesh and bone, bore his fate with less fortitude, and cried bitterly. A rough-looking fellow, who stood by, and seemed to be a sort of foreman among the workmen, took his pipe from his mouth, spat out, and in a blunt advising tone said, addressing the boy, 'Crying 'ill do thee no good, lad; thou'dst better have it cut off from above the knee.'"

The author of "Our Iron Roads", a book about railways published in 1852, relates many stories about the navvies. To the Victorians courage, even when it degenerated into recklessness, was one of the greatest virtues. They could not help giving a grudging admiration to men who killed themselves (as several were killed at the Kilsby Tunnel) playing follow-my-leader across the mouth of the tunnel shafts.

"Their coolness and daring were also extreme. A workman employed on the Scottish Central Railway had lighted the fusees connected with some charges of gunpowder by which a blast was to be effected, and having given the signal to be drawn up, the rope slipped, and the poor fellow was suspended but a few feet above the spot where the explosion was about to take place. His presence of mind, however, did not forsake him. He called out that he might be lowered again, and then approaching the burning fusees, he extinguished them one after another, and his life was saved. They had burned within half an inch of the powder."

On another occasion, the end of a tunnel fell in on the Midland line, trapping some of the men inside it.

"To dig the whole of the tunnel entrance out again was in the time, and with the nature of the soil impossible, and

the engineers resolved at once to sink a short shaft from above through which the prisoners might be brought; and after some three and twenty hours of most strenuous work by relays, the men were reached. They were found to be lying, exhausted from want of air, upon the floor, and their candles were flickering in their sockets; but they were saved. It was then learned that, when the tunnel end fell in, one of the men had exclaimed to the others: 'Well, chaps, we shall never get out alive, so we may as well go on with our bit while we can.' And they went on till they could go on no longer."

The navvies seemed to have no families and no ties—a nomadic army for ever on the march. Wherever they were at work, particularly in out-of-the-way places, they were fleeced by an army of small traders, who ran up shanties in which the men simply had to lodge for lack of other shelter, and in which they had to pay high prices for food, drink and a bed. Four truckle-beds in a room would be made to serve sixteen men, two in a bed, one shift sleeping by day and the other by night, like Box and Cox. The men were paid good wages, but the money melted away into the hands of the lodging-house keepers, or to the "tommy-shops".

Henry Mayhew, a man who made a hobby of the seamy side of life, once took down the story of an out-of-work navvy whom he found in a Refuge for the Houseless in London. This man had been working on the railways since he was a boy of nine, beginning on the Liverpool and Manchester Railway. He was bitter in his condemnation of the contractors and their "tommy-shops".

"Every contractor and sub-contractor had his tommy-shop that he forced his men to deal at, or else he wouldn't have them in his employ. At the tommy-shop we was charged half as much again as we would have had to pay elsewhere, and its the same now, wherever these tommy-shops is. What the contractors, you see, can't make out of

the company, they fleeces out of the men. Well, sir, I worked on that line through all the different contracts till it was finished; sometimes I was digging, sometimes shovelling. I was mostly at work on open cuttings. All this time I was getting from 2s. 6d. to 3s. and 3s. 6d. a day; that was the top price; and if I'd had the ready money to lay out myself, I could have done pretty well, and maybe put a penny or two by against a rainy day; but the tommy-shop and the lodging house took it all out of us."

Not all the contractors were dishonest, nor were all of them like the timorous gentleman who took to his bed and died when the Kilsby Tunnel failed. Many were also of the heroic breed, men like the great Tom Brassey—"that noble and genial man—the Prince of contractors".

Thomas Brassey was a little younger than Robert Stephenson, and started life as a land surveyor and estate agent in Wales. In 1834 he met George Stephenson, who persuaded him to take a contract for a viaduct on the Grand Junction Railway. He decided to make railway contracting his profession, and before his death (hastened, like that of so many of his contemporaries in the engineering world, by overwork) he had built railways in France, Italy, Canada, Russia, Australia, India, and the Argentine. He made an immense fortune, but he made it with absolute honesty, and was beloved by all who worked for him. "If he'd been a parson," said one of his employees, "he'd have been a bishop; if a prize-fighter he'd have had the belt."

When he was building a railway in Spain, a disastrous season of floods and landslides played havoc with the works. Message after urgent message was sent to him to come and see the damage.

"I think I shall wait until the rain has entirely ceased," he remarked calmly. "Then we'll go over and find out what is left of the works, and I shall thus be saved some useless journeys!"

He lost £200,000 on that contract, and all he said was:

"Well, we can't always gain; we must lose sometimes, and bear our losses patiently."

These were the kind of men—engineers, labourers, and contractors—who belonged to the Heroic Age of railways. They might well have the same epitaph as Sir Christopher Wren: "If you seek their memorial, look around you."

CHAPTER XI

THE AGE OF STEAM

By the year 1843 the bones of the British railway system had been strung together into a strong and reasonably efficient skeleton. The only one of the great trunk lines not yet begun was the Great Northern (afterwards the L.N.E.R.), which was not started until 1847. All the lines which had been passed by Parliament during the railway building boom of 1836–7 had been completed, and as, during that boom, good sense and courage had walked hand in hand, the railway system of 1843 merited nothing but praise, at least from the engineering point of view.

There were more than 2,000 miles of railway completed and in use, and some hundreds still under construction. There were no fewer than a *hundred* separate and distinct railway companies in existence, most of which had been born before 1840. During the last three years the formation of new companies had been practically at a standstill; there had been one new one in 1841, five in 1842, three in 1843, compared with twenty-nine in 1836. Trade was much slacker than it had been, money less plentiful, and many people thought that England now had all the railways she could profitably cope with. They were shortly to change their minds. In London, the Railway Clearing House had recently been set up to deal with the complicated accounts of the various companies. Two thousand miles of line divided among a hundred companies is not a large amount. Passengers travelling long distances, particularly across the country—for instance, from Chester to York or from Lancaster to Nottingham—might have to use the lines of a dozen different companies. Some of these companies had private arrangements with other companies to run trains over their tracks on payment of tolls. The London and

Birmingham, for instance, ran its first-class trains right through to Liverpool over the Grand Junction and the Liverpool and Manchester. Other companies had no such arrangements, and the unfortunate passengers had to cool their heels on railway platforms for more hours than they spent in the trains. A central office, like the Clearing House, was obviously a necessity to deal with permissions, tolls, through tickets and so on, but it was not at all popular at first with the railways, and in the first three years only sixteen companies were entered on its books.

There were few railways in the British Isles outside England. Scotland's main line connected Edinburgh with Glasgow, and had branches to other Lowland towns—Leith, Greenock, Ayr, Kilmarnock. Wales had two short lines connecting the coalfields of the south with the sea at Llanelly and Cardiff. Ireland had a solitary railway from Dublin to Kingstown—five and a half miles long.

There were only forty-one towns in England with more than 25,000 inhabitants, and twenty-seven of these were already provided with railways—not railways to everywhere, but at least railways to somewhere. The routes were often very roundabout. If, for instance, in that year of grace 1843, one had wanted to travel from Lancaster to Darlington, a distance of sixty miles, and had insisted on doing the whole journey by railway—which would have been extremely ill-advised—the route would have covered some 150 miles of railway track, owned by seven different companies. From Lancaster the first twenty miles was over the Lancaster and Preston Junction, a finely engineered line almost as straight as a Roman road. At Preston one changed for Manchester, and this lap of thirty-odd miles was done in one train, although over three lines—the North Union, the Bolton and Preston, and the Manchester and Bolton. At Manchester there was another change, this time into the Manchester and Leeds, Old George's famous line, which wound circuitously round two counties as it tried to cross the Pennines and, in spite of its name, never got to Leeds at all, but left its passengers at Normanton. From

Normanton the York and North Midland ran to York, and the last lap was done over the Great North of England (" Great ", as befitted a line with no fewer than forty-four miles of track). But no one in his senses would have undertaken such a fanciful journey, any more than to-day one would choose to go by air from Glasgow to Dublin, via London. The direct route was still by the coach-roads over the Pennines.

On the whole, the lines that were most needed had been built. The mining districts of the north-east and the cotton district of South Lancashire were especially rich in railways, most of them very short lengths of line designed for a particular industrial purpose. So far no one had thought that it was worth running a railway line through purely agricultural country. The iron road was the handmaid of industry, and the flat agricultural counties of East Anglia and Lincolnshire in the east, Dorset and Wiltshire in the south-west, had to do without.

From London the railways radiated like the spokes of a wheel. One could travel north from Euston by the London and Birmingham, which went on to Liverpool and Manchester by the Grand Junction, or west by Brunel's magnificent broad-gauge railway from Paddington. The Great Western was not yet completed. It already reached Bristol and Taunton, with branches to Oxford and Cirencester, and there were plans to take it down into Cornwall via Exeter and Plymouth. From London, too, there were lines to the south coast, from Nine Elms to Southampton, or from London Bridge to Brighton and Dover. (Both these London termini were on the Surrey side of the Thames. There were as yet no railway bridges across the river.) From Shoreditch the Eastern Counties Railway ran to Colchester and the Northern and Eastern to Hertford.

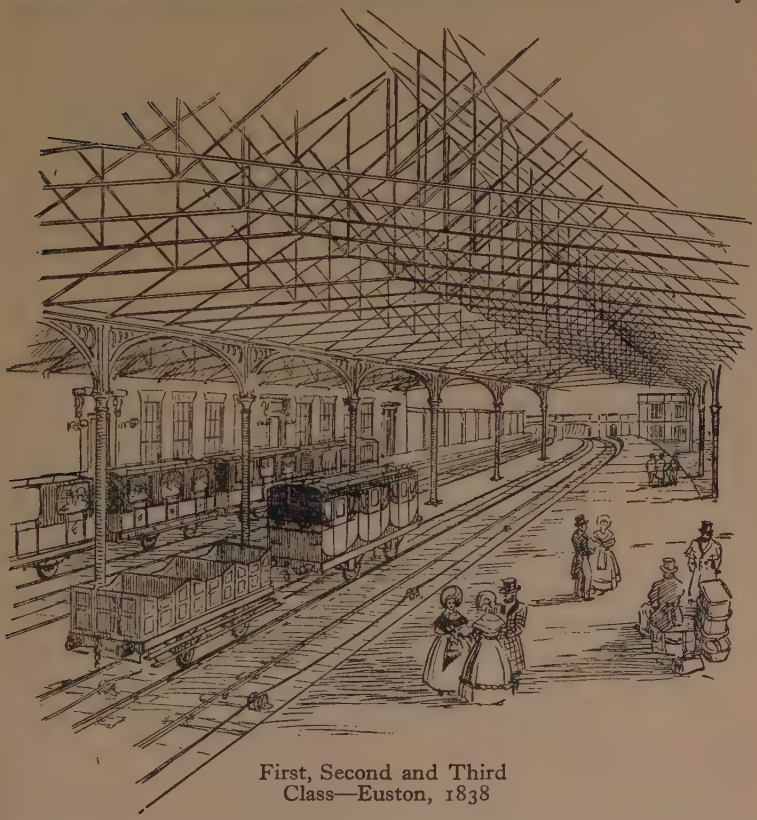
In some places the civic authorities had altered the appearance of the railway map. Worcester was one town which for long refused to sanction the railway. Northampton was another, which afterwards regretted its decision. At Oxford it was the University which forbade the pernicious thing, and

every passenger to that city still suffers in consequence. The Eton College authorities shared this view. Not only did they refuse to have the railway at Windsor, but they managed to get a clause inserted in the Great Western Act forbidding the Company to build a station at Slough, some three miles away. The Great Western did not build a station. They simply stopped their trains without one, and sold tickets at the nearest inn. The Provost and Fellows were extremely angry at this evasion of the Act, and tried without success to obtain a Chancery injunction against the G.W.R. But even while they were applying for the injunction they were also making arrangements for a special train to take the boys to London for the Queen's coronation. Two years later they gave in altogether and allowed the Slough station to be built.

Along the railway routes, the coaches were already dead, and many people, from Charles Dickens downwards, were in full sentimental mourning for them, a mourning which has survived even into our own days. The mail-coach, with its beautifully matched team, was a lovely sight, there is no doubt, but there was a darker side to that dashing cavalcade. The coach-owners expected, on the average, to lose one horse every 200 miles, so strenuous was the pace. The coaches were colourful, too, with their bright paint and uniformed guards. But colour did not die with the passing of the coaches. The railways did their best. The countryside through which the Newcastle and Carlisle line passed for instance, was made brighter by the trains. The first-class carriages were yellow, picked out in black, with coats-of-arms painted on the door-panels. The second-class carriages (there were no third) were black picked out in green. The luggage-vans and horse-boxes were green, and, crowning glory, the passenger guard aloft on his perch wore a uniform of scarlet-laced coat, drab trousers, and cream-coloured hat. But gaiety and colour were only incidental to railways, as they had only been incidental to coaches. The important thing was quicker, better communications, improving trade, bringing prosperity.

By 1843 the first wave of railway building was over. People

had had time to draw breath, to look round and see that those lines which had been built were progressing very well. A large percentage of the upper and middle classes—the influential part of English society—had had a chance to use the railways



First, Second and Third Class—Euston, 1838

and see for themselves what a difference they made to life in general. It was easier to do anything and everything by railway. It was easier for women to get up to London to see the latest fashions. It was easier for boys to get to and from the public schools. It was easier for M.P.s to get to their constituencies. It was easier for business men to divide their time

between various markets. It was easier for naval officers to rejoin their ships, for farmers to sell their produce, for relations to visit one another, for sick people to reach hospital. A great wave of interest spread through the country as it was brought home to people in so many different ways that the railways were a blessing. Those who had invested in the railways were earning a very pleasant dividend. Those who had not, began to think that they would like to. Trade had revived and money was a little easier. People wanted good investments. So began the great railway boom, afterwards called the "mania", of 1845 and 1846. To the ordinary person, "booms" and "slumps" are mysterious things. Whole masses of people are moved to do the same thing at once, as suddenly and inexplicably as the swarming of a hive or the migration of flocks of swallows. No one knows how it begins or how the impulses are passed from one person to another.

The railway mania began as sober investment and ended up as wild speculation. Those who had no interest in the railways, or trade, or the country bought shares simply to re-sell them at a profit. Demand was brisk. Everyone wanted to be in on a good thing. Shares in railways which had not yet been built changed hands at double or treble their proper price. Everyone was so eager to buy and to pass on at a profit that it became rather like that nursery game in which one has to get rid of the parcel before the music stops. People without money (since to buy a share demanded only a few shillings down, the rest to be called up at some future date) bought, trusting to be able to get rid of their shares at a profit before the rest of the purchase price was demanded from them. All they wanted was to get rich quick. They forgot that they were playing with bubbles, that buying and selling a commodity that does not exist cannot be real prosperity, or, if they did remember, they trusted to their own cleverness to get out with their gains before the inevitable crash, leaving someone else to hold the parcel.

The crash came as it had come in 1826, and in 1836, only no one seemed able to remember so far back. The music

threatened to stop. No one wanted to hold the parcel, even for a moment. Confidence wavered, gave way to doubt. Doubt increased to panic. Everyone realised at once, and wondered why they had not realised before, that the bits of paper which had seemed so precious were only bits of paper. They represented nothing. They represented shares in railways which at the best would take years to build and at the worst would never get Parliament's permission. Everyone tried to sell. No one wanted to buy. Prices tumbled to nothing at all, and some of those who had reckoned themselves as worth thousands, who had set up their carriages, sent their children to expensive schools, bought houses, given magnificent parties, found themselves suddenly worth nothing, and with the unpaid tradesmen knocking at the door—tradesmen who were the more eager to get their money because they in their turn owed it to others.

A country's economy is built on confidence. If all these people had decided to trust one another, there would have been no crash. But panic is a very catching thing, and there was no one to give a lead in the matter of confidence.

There were some people who had frowned on the mania. Old George Stephenson, for instance, had bought shares in railways because he believed in railways and intended to support them. He had no intention of selling out, whatever the profit. Robert, after his scare over the Stanhope and Tyne, was extremely wary of taking shares in railway companies. He foresaw the crash well enough, and urged his father to get rid of the shares he held while there was time.

"No," said George firmly; "I subscribed for those shares to hold during my life-time, not to speculate with."

When he went to a dinner of the directors of the Leeds and Bradford, he told them what he thought of speculation.

"It's like walking over ice," he said, "with shallows and deeps underneath. The shallows are frozen over, and they'll hold well enough, but not the deeps. During the next year or so there'll be many who'll step on places not strong enough to carry them, and in they'll go; they'll be taking shares and not

be able to pay the calls on them afterwards. Yorkshiremen are reckoned clever men, and my advice to them is, to stick together and build railways in their own neighbourhood, not to be going abroad with their speculations. If any of you have done that, I recommend you to get your money back as fast as you can, for if you don't you'll never get it at all. My earliest holding of railway shares was in the Stockton and Darlington, and I had three shares—it was a large capital for me to have in those days. But a friend in Stockton was very anxious to hold a share, so I sold him one of them, at a premium of thirty-three shillings. I think I must have been the first man in all England," said George, " to sell a railway share at a premium."

But in spite of words like these from sober-minded people, the average speculator went ahead with his schemes to make as much money as quickly as possible. Not the least surprising aspect of the mania was the wide net which it cast. The " average speculator " was not a shady City man. He was everybody, from the highest to the lowest in the land, men and women, young and old, rich and poor, and this made the crash, when it came, so much the more disastrous.

No one could say that they had not been warned. *The Times* saw the danger. It pointed out that the total annual income of the country was about £200,000,000. Yet in 1846 alone Bills went through Parliament authorising the raising of £132,000,000 on railways. It was obvious that this sort of thing could not last. It was not real money that was being spent on railways. How could a nation continue to live if two out of every three shillings were being poured into the pockets of the railway companies ?

Punch protested too. Recently established, *Punch* took its responsibilities seriously, and threw itself wholeheartedly into many battles. Because of its striking cartoons and amusing articles, it found its way into many homes where the solemnly thundering *Times* could not penetrate. John Leech drew a savage cartoon showing men and women worshipping in front of a gigantic railway engine labelled " speculation ". They kneel and pray to the monster, throwing down their money in

front of it as an offering, in such an ecstasy that they do not seem to care that the engine is rolling slowly forwards, crushing them beneath its wheels. In the corner of the picture a group of ravenous crocodiles, wearing lawyer's wigs, wait with grinning mouths. Whoever else suffers, *they* will not go hungry.

The most remarkable figure in all this remarkable time was George Hudson—"King" Hudson. He towered over the mad scramble for money. In another of its pungent cartoons *Punch* showed him holding his royal levee, with bishops, generals, ladies in court dress, peers in ermine, crawling to kiss his foot.

George Hudson was the fifth son of a farmer on the Yorkshire Wolds. He left home, after a little schooling, to make his fortune at the age of fifteen. He found a job in a draper's shop in York, married his employer's daughter, and by hard work and a certain pushfulness became a partner in the business. When he was twenty-seven by a stroke of great good fortune he became a rich man. A great-uncle died leaving him £30,000. It is hard to believe that even without the money he would have remained behind the counter all his life, for he had a character which would not remain content to manipulate a tape-measure.

"It was the very worst thing that had ever happened to me. It led me on into railways, and to all my misfortunes since," he said at the end of his life, but it is hardly likely that he meant it.

With this money to back him, he began to take a share in the civic life of York, interested himself in politics (which in those days before the Reform Bill meant providing money for bribery), and began to think about railways. It was a time—in the early thirties—when everybody in the north was thinking about railways, stimulated by the success of the newly opened Liverpool and Manchester Railway.

In 1834 Hudson met George Stephenson, and oddly enough the two became great friends, and stayed so to the end of George's life. Hudson joined in the purchase of the Clay Cross Collieries, and was afterwards the promoter of many

lines which George and Robert engineered. In the beginning they made friends over the idea of a railway from London to Edinburgh, which had always been one of Stephenson's favourite dreams. When Hudson first met him he was at work on two stretches of line which would eventually form links in the chain, and his idea was that Leeds would be the chief junction in the north. Hudson immediately saw that here was a chance to make the sleepy mediæval town of York into an important place, as it had been years ago.

"Make all the railways come to York," was his slogan, which became a battle-cry, and the number of twentieth-century travellers who have at one time or another looked at York Minster "between trains" is the proof of his success.

Hudson had the mind of a modern big business man, as well as the enormous energy which he shared with so many of his contemporaries. His schemes were immense. He could grasp the possibilities of an idea in a flash, and carry them out down to the last detail. Without typewriters, telephones, taxicabs, or any of the modern paraphernalia he built up an empire of trade, all the threads of which he kept in his own competent hands. He began in a small way, but in his heyday, during the great mania, he was managing director of a quarter of the railways of Britain—of 1,500 miles out of a total of 5,000. He was an M.P., with all the work of piloting railway bills through Parliament as well as the ordinary business of the House. He was managing director—and he did manage and really directed—of many other industrial enterprises, from docks to boarding-houses at Scarborough. He was chairman of an important bank, he manipulated the Stock Exchange to suit his own interests, he bought houses and farms and created parks and woodlands—he seemed to have a finger in every pie.

"The Railway Napoleon", he was called, "the Colossus of Railroads", "Jupiter", "the Yorkshire Balloon"—but for one person who distrusted this "big swollen gambler" hundreds followed him slavishly, because he offered them a chance to get rich quickly, and so touched them in their tenderest place.

With it all, Hudson was a kind-hearted man, and he found time to be marvellously generous, not only in public. When they made him Lord Mayor of York he entertained more lavishly than had ever been known, and the opening of one of his railways was hailed with a long day's festivities, beginning with a banquet at breakfast time and ending with a gorgeous ball which lasted till the next breakfast time. There were also many poor and insignificant families who remembered his kindness, and he would take endless trouble over a case which appealed to him. By a curious inconsistency, he took a pride in paying the lowest possible wages. He would cut down the small salary of some clerk in a public office by a few shillings a week, and on his railways accidents were often attributed to his policy of underpaying the servants, so that they were not the best men.

The Railway Mania undermined public morals completely with the tempting chink of gold. People who led exemplary private lives were demoralised by the longing for money. So long as money was forthcoming they did not care to ask questions, and a man like Hudson, who had, it appears, a very pleasant disposition but no business morals at all, was bound to rise. The justification of his methods in the eyes of the shareholders was that he delivered the goods. His shares were always at a high premium, and fat dividends appeared on every half-yearly balance sheet. If ever he failed to deliver them, then the wolves would be on to him, but the prospect of riches kept them happily quiet. No one bothered to ask how the money was produced, or if this very pleasant dividend had been honestly earned by the railway. Very often it had not, and it should have been apparent to anyone who checked the balance-sheet, even though Hudson's balance-sheets were drawn up on no known principles. Hudson himself unashamedly told his managers to pay a large dividend "just to make things pleasant". But the shareholders, who should have kept a check on this sort of thing, remained quiet. Those who did ask questions were shouted down. It was well known that Mr. Hudson did not like to be asked questions. Sometimes he

threatened to resign. This always produced the desired effect, for there were few people so rash that they wanted to kill their golden goose. Hudson's railways paid their shareholders better than anyone else's. That was the one incontrovertible fact.

Once, on the way to a general meeting of one of his railways, the " King " boasted to a friend:

" I'm going to ask the shareholders to give me two and a half millions of money, and I won't tell a soul of them what I'm going to do with it."

He did ask them, and they did provide it, without knowing in the least for what purpose it was going to be used.

Even his fellow directors were left in the dark.

" Being equally responsible with yourself for what is done," they said, " we are desirous of knowing your plans."

" You are, are you ? Then you will not," was all the answer they got, and they meekly left it at that.

George Hudson cannot be called an embezzler pure and simple. He loved power and money, but he had great business ability, and really did enrich the people whose money he used in such a peculiar way. He simply did not understand why he, whose flair for railways was so far above other people's, should be accountable to them for his actions. They entrusted their money to him. Well and good. It ceased to be their business to know exactly how he used it.

His empire spread. He bought up this line, amalgamated with that, arranged a private deal with the directors of the other, was elected chairman of the fourth, and so on. He did not monopolise railways merely from a selfish point of view, but because he saw—and he was very right—that unlimited competition was going to be the death of the railway system. It was not until 1921 that combining of companies on the scale which he foresaw came to pass, and not until 1948 that the British railway system really caught up with George Hudson's ideas and became one concern.

Perhaps if he had been an Alexander or a Napoleon, and above finding out, he would have been one of the great figures

of history, but that could not happen in commercial nineteenth-century England. He was bound to be found out in the end.

Some people said openly that they had " sat down to dinner £20,000 richer than when they had breakfasted, solely through being in the know of Hudson's plans ".

The Stock Exchange is far too complicated a machine for most people to do more than pass it by with a respectful glance, but a very simple example will suffice to show the kind of scheme by which an unscrupulous man can enrich himself and his friends.

A is a man like Hudson—of great influence in railway matters. One day it is rumoured that he is selling out his shares in a certain railway, so immediately many investors think there must be something unsatisfactory about the line, and follow his example. When A sold his stock, each share stood at £10, but the general anxiety sends the price down to £5. While they stand at £5 B buys a good many, but very quietly and carefully, so as not to increase confidence in them. Next day, or next week, A appears to discover that this railway is really perfectly all right, and buys back his original shares at £5. The price soars as the small investors once more hurry to follow the great man's lead, and soon stands at £10 again, at which price B sells all that he had bought. Both A and B have made a handsome profit by buying shares at £5 and selling them at £10, but actually A and B are the same person, A openly himself, and B incognito through his various agents. This little story is very crudely told, and operators on the Stock Exchange have to use a good deal more finesse than that, but the principle is one that Hudson used more than once.

There were other curious goings-on as well. As chairman of one company, Hudson sold shares to himself as chairman of another company at a price well above the market level, and put the difference into his own pocket. Accounts were cooked, either by the chairman himself or by his secretaries, who followed him slavishly. Strings of noughts were added to figures

to make things look impressive, and the most odd ways of reaching totals were used. Everyone knows that statistics can be made to prove anything. They certainly did on Hudson's balance-sheets. In all, some £500,000 of shareholders' money found its way into his own pockets, besides the millions which he juggled with and used for all sorts of purposes quite different from those for which the owners had invested them.

But, so long as the mania lasted, nothing could rock the "King" on his throne. The whole country was involved.

> "The game was open to all—to the workman, who drew his accumulation of small earnings out of the savings' bank to try a venture in shares; to the widow and spinster of small means, who had up to that time blessed God that their lot had lain between poverty and riches, but were now seized by the infatuation of becoming suddenly rich; to the professional man, who, watching the success of others, at length scorned the moderate gains of his calling, and rushed into speculation. The madness spread everywhere. It embraced merchants and manufacturers, gentry and shopkeepers, clerks in public offices, and loungers at the clubs."

Parliament was as badly infected as anywhere else. M.P.'s and Peers were almost open in selling their votes to railway promoters to get the Bills through Parliament. One company boasted that it could command 100 votes in the House of Commons. During one year only, 157 M.P.'s had their names on the registers of new companies—had a financial interest, in fact, in passing certain Bills and obstructing others belonging to rival companies. Engineers were in enormous demand, and many of them did not hesitate to recommend any line, however impossible, so long as they were well paid. Robert Stephenson, whose name was well known and carried more weight than any other, except perhaps Brunel, used to receive mysterious presents from companies for whom he had never worked, but who hoped in this way to grease the wheels. One morning there was more than £1,000 in unsolicited gifts among

and shady practices were brought to light. The King was dethroned but he was never prosecuted, for too many people's names would have been dragged in the mud with his. He was allowed to escape and live in obscurity until he died. Only *The Times*, unafraid of public opinion, had the courage to speak up for him in his downfall, as it had had the courage to condemn him in his prosperity.

"The system is to blame [it said]. It was a system without rule, without order, without even a definite morality. Mr. Hudson, having a faculty for amalgamation, and being also successful, found himself in the enjoyment of a great railway despotism, in which he had to do everything out of his own head, and among lesser problems to discover the ethics of railway speculation and management. Now we do not hesitate to say that it is a severe trial to anybody to be placed in a novel situation of great power and varied opportunities. . . . We think the King and his subjects are much of a piece. . . . Mr. Hudson found himself everything at once—a large shareholder, a comprehensive projector, a chairman, a trustee for shareholders, an agent for particular transactions—a broker, a contractor, a banker, a confidential friend of landowners, and a good deal more besides. Had he discharged all these functions with perfect fairness, he would have been little less than an angel, and that he certainly was not."

CHAPTER XII

OLD GEORGE

George Stephenson had nothing to do with the railway mania. He was not a man to forget old friends, and he always liked George Hudson, but at the height of the Railway King's power their friendship cooled a little.

> "Hudson has become too great a man for me now [Stephenson wrote to a friend]. I am not at all satisfied at the way the Newcastle and Berwick line has been carried on, and I do not intend to take any more active part in it. I have made Hudson a rich man, but he will very soon care for nobody, except he can get money by them."

He retired from the railway battle in 1841, or almost retired, for he was still consulted about various projects, and sometimes took a hand in engineering a piece of line that was particularly interesting to him. Most of his lines he handed on to Robert, some to John Dixon, and others to his "lads", who were now all well-known civil engineers.

He wanted leisure, but he had no intention of being idle. The Snibston colliery being in excellent working order, he had bought another estate in Derbyshire, near Chesterfield. The Clay Cross Collieries were not at first as successful as the Snibston ones, for various reasons, but the working of them, and of some lime-works which he founded on the same estate, made up to him in interest what they lacked in profit. He was now a wealthy man, and the fact that the works were not a great success for some years bothered him little, financially, although as a canny north-countryman he never liked any scheme which did not pay. He certainly did not allow any consideration to affect the well-being of his workpeople.

Fifteen hundred men worked in the mines and the lime-

works at Clay Cross and Ambergate, and the hamlet of twelve houses which had originally been there soon grew into a little town. Stephenson was fortunate in the manager of his works, and between them they worked out a scheme which ensured that none of the people, nor their children, should labour under the disadvantages which had hampered the master in his youth.

Every man in his employment had to pay a few pence a week into a central fund. This fund provided day-schools for the children, night schools for the men who wanted them, lectures, a reading-room and library, medical attention, sick relief, compensation for injuries—all the things which nowadays are provided on a national basis but in those days depended on the philanthropy of individual employers. Nor did the Clay Cross Institute only provide for these praiseworthy objects. Old George never suffered from the curious delusion that affected many of even the best employers of his time, that sober thrift was the only virtue allowable to the lower classes, and that the most innocent amusements became somehow reprehensible in working people, because they took their minds off the hard labour of life. The Clay Cross Institute provided for a band, a choral society, a cricket club, dances every fortnight, and prizes for the best gardens.

Stephenson was not only generous, he was tactfully generous. He wanted no one to be made to feel that they were objects of charity. He could, it was said, give a poor man a £5 note in such a way that he seemed to be asking a favour rather than conferring an obligation. There was a great deal of misery, hard masters and low wages, in the "hungry forties". It is very pleasant to know that there were also men like "Old George".

The house which he bought with the Clay Cross estate was a large, pleasant, eighteenth-century brick building, at the top of a steep hill outside Chesterfield. From its lofty garden he could see between trees over miles of the green Midland country, with the crooked spire of Chesterfield church against a background of Derbyshire hills. Between the town and

the house, the railway—his favourite railway, the Midland —ran in a deep cutting at the edge of his park, so that he could see the smoke and hear the whistle as the trains rattled away to London. One of the first improvements he made in the neglected grounds of Tapton House was to cut a path down the hillside to the railway.

A little boy who used to haunt the park after birds' nests, and who knew nothing of Stephenson except that he was the owner of "the big house on the hill", said, when he was grown up:

"So far as the dignity of his appearance and manner were concerned, the aristocracy would have had no cause to be ashamed of the man who had begun life as a common labourer and without being even taught his letters. The present writer as a boy has a vivid remembrance of the fine white-haired old man, his clear ruddy face, his merry grey eye. He was tall, and I do not call him to mind as of spare figure, which he is reputed to have been, but I see him as a stalwart-looking gentleman, well knit, standing firm on his feet, and having a general air of benevolence and strength. He invariably dressed in black, a frock coat with square pockets behind, and he always wore a white neckcloth, or 'stock'. He was a distinguished-looking man. His figure and pose are faithfully perpetuated in the statues of him in Euston Square and at his favourite town of Newcastle-on-Tyne. I have seen him standing by the railway at the private crossing which led to his park: I have seen him standing watching the Midland express thundering along the flat gradients which he defended; and it has often occurred to me since to wonder what his thoughts could have been, as he stood with his hands behind his back, gazing down the line long after the train had disappeared, and the birds, whose songs it had stilled for the moment, piped again their joyous notes."

In the last quiet years of his life he did not find it difficult to slip into the ways of a country gentleman. In that little square garden at Killingworth, with the "fley-craw" and the curious catch on the wooden gate, he had enjoyed growing cabbages and onions larger than anyone else's. Now that he

was a rich man he found the same enjoyment in growing pine-apples and melons, and used the same mechanical ingenuity to improve his hot-houses and forcing-frames.

The only man whom he would acknowledge as his master was Joseph Paxton, head gardener to the Duke of Devonshire. Chatsworth was only a few miles from Chesterfield, and the two men became great friends, for they shared many of the same interests. Paxton was a very ingenious and intelligent man, who began life as a gardener's boy, and ended it as " Sir Joseph ". The title was a reward for a curious idea he had of a palace like an immense greenhouse, made all of glass, for the Great Exhibition in Hyde Park.

George's ambition was to grow melons " as big as pump-kins ", he said. His pineapples and grapes were enormous, and his cucumbers gigantic. The only thing that troubled him was that, cucumber-fashion, they insisted on growing curved, and it seemed to his mechanical mind that they would look much better if they were straight and symmetrical. He tried all sorts of devices to cure their obstinate curliness, and at last hit on the idea of sending to the factory at Newcastle for a number of glass cylinders. The baby cucumbers, put into these cylinders, swelled and filled them, and simply had to grow straight.

" I think I've bothered 'em now," said George happily.

He did not read, for he had not learnt young enough to make reading a pleasure. Besides, novels upset him. He was an emotional man, and took the characters' troubles to heart as though they were his own. He hated writing, and dictated all his letters, which were much fewer now that his engineering career was over. He was happiest outdoors, riding old Bobby about the countryside until the old horse was past work and was pensioned off in a comfortable meadow. Stephenson never got another horse. He had been too fond of Bobby. He loved his garden, and the park, and the fields, and spent a great deal of his time just wandering about enjoying things. Each spring found him, as it had done any time the past sixty years, poking along the hedges for birds' nests, and

paying them daily visits to see that no one disturbed them once the eggs were laid. He wrote a long letter to Robert about a pair of robins which had nested in the attics, and which came sadly to grief because a servant shut the window without seeing the nest in a corner of the room. He kept rabbits, and chickens, and cows on a tiny farm, where he experimented with feeding-stuffs and stock-breeding, and applied theories of engineering to agriculture.

"You see, sir," he explained to a visitor, "I like to see a cow's back at a gradient something like *this*, and then the ribs or girders will carry more flesh than if they were so, or so "—illustrating his meaning with diagrammatical flourishes in the air.

Best of all he liked people, and Tapton House was rarely empty. All sorts of people were glad to be his friends, from Sir Robert Peel, the Prime Minister, to working-men from Newcastle. He was a man to whom class distinctions mattered very little, in an age when to most people they mattered very much.

A visitor to the Newcastle works was more struck by Stephenson's attitude to his men than by all the mechanical marvels.

"They spoke to each other as man to man, he said, "and nothing seemed to please the master more than to point out illustrations of the ingenuity of his artisans. He took up a rivet, and expatiated on the skill with which it had been fashioned by the workman's hand—its perfectness and truth. He was always proud of his workmen and his pupils; and while indifferent and careless as to what might be said of himself, he fired up in a moment if disparagement were thrown upon anyone whom he had taught or trained."

Someone else noticed with some amusement that when Stephenson met his old friend Mr. Brandling (an extremely important local magnate) in Newcastle streets, he shook hands warmly with the gentleman, and then shook hands even more warmly with Mr. Brandling's coachman, whom he had known since they both worked at the pit.

"Why, madam," he said once to a chance acquaintance who

asked him his name, " they used to call me plain George Stephenson. Now they call me George Stephenson, *Esquire*, of Tapton House, near Chesterfield. I've dined with princes, and peers, and commoners, with persons of all classes, from the highest to the humblest. I've made my dinner off a red-herring in a hedge-bottom, and gone through the meanest drudgery. I've seen mankind in all its phases, and the conclusion I've come to is that if we were all stripped, there's not much difference."

On another occasion he was asked what were his " ornamental initials ".

" I have to state," he wrote back, " that I have no flourishes to my name, either before or after ; and I think it will be as well if you merely say ' George Stephenson '."

He was more than once offered a knighthood, but refused it. He was a knight of a Belgian order, but never used the letters to which he was entitled. The only flourish which he coveted were the simple letters " C.E.", but the Institute of Civil Engineers never forgave him for being an amateur, and it was many years before they offered him even a chance of entering their august portals. Strictly speaking, he was not eligible for membership because he had never served a regular apprenticeship. This consideration the Society were prepared to waive, but they insisted that he went through the normal forms of admission. Old George was too proud and too obstinate to comply with this. He would go in, he said, upright, and not stoop an inch. It galled him too much to be made to fill in a form detailing his practical experience, like every half-fledged engineer, and be recommended by men half his age, many of whom had been his own pupils. The Institute had conferred honorary membership on various distinguished people, they might do the same for him. They would not, however, and to the end of his life George remained an amateur and a quack in the engineering profession.

When he spoke of " dining with princes " it was true enough. He had been specially invited to Belgium by King Leopold, who was extremely interested in railways, and wished to have

the best advice. The result was that Belgium was the first country to lay out its railways, from the start, as a State project, and for many years the Belgium railway system was the admiration of many people in Great Britain, where the evils of unlimited private enterprise and competition were only too apparent.

George Stephenson and Robert both went to Belgium as early as 1835, when George was awarded the Knighthood of the Order of Leopold. Robert was given the same honour a year or two later. George had been entertained to dinner by the King and Queen, and was as cheerful and as self-possessed, as entertaining and as entertained, as when he dined with the colliers beside an engine fire. No doubt he made some mistakes of etiquette, but they can hardly have been serious ones, for he had natural good manners and dignity enough to carry him through any situation. The visit passed off very well, and was the first of several.

On another occasion he was invited to a civic banquet in Brussels. The hall was hung with flags, there was a bust of himself on a marble pedestal, crowned with laurels, and everyone cheered him until the roof rang. But the thing he liked best, that he did not notice until half-way through the magnificent dinner, was a little model engine in the centre of the table. It was "Rocket" enthroned under a triumphal arch. This was in 1845, when he had almost completely retired in England. He was sixty-five, and beginning to feel his years, although that same summer he went to Spain to survey a line along the north coast, and worked as he had been used to work, surveying all day and resting at night in any peasant's cabin where he could find shelter. It was too much for him at his age, and the journey home was worse. Although he had few engineering connections in London then, the work that he had in hand demanded his presence at the end of November, when the plans went before Parliament. He travelled night and day from Spain to get home in time, and contracted pleurisy on the way. He recovered after some weeks of illness, but from then on he had to take life more gently than he had been accustomed.

He did not leave Tapton House very often. Sometimes Robert came up for a night or two from London, but not very frequently, for he was, as always, overworked. When he did, he and his father talked for hours and hours, as they had always done. George's greatest pleasure was to say, "Let's have a crowdy night, Robert!" They sent for oatmeal and hot water and milk and spoon and basin to the kitchen, and the two eminent engineers would proceed to make "crowdy" over the study fire. Supping it, they forgot to talk about the latest engineering news, Robert's great railways, or his father's magnificent greenhouses, and slipped back into talk of old black pumping engines, and the cottage at West Moor, and the sun-dial, and the donkey, and told the often-told stories all over again.

Sometimes George went up to Newcastle to visit old friends and relations. He enjoyed these visits, and was always welcome wherever he went. He had crowds of Northumbrian relations—Stephensons and Liddells and Burns and Elliotts and Hendersons and Hindmarshes—all of whom were proud to be his kin. They used to remember, and tell one another, until it became quite a family legend, that he had once said, at the beginning of his good fortunes, "You'll never see no change in me."

"And he never has changed," they would say—"never. He's always been the same—riches have made no difference in him."

Less and less frequently he went up to London. He liked seeing Robert, but Robert was always busy, and there was little else that he cared to do. A friend took him to the opera, but he was sound asleep before the end of the first act. He went to the Haymarket to see "Black-eyed Susan" on his birthday, and he enjoyed that, if one could call it enjoyment, for his too-ready sympathy kept the tears rolling down his face most of the time.

He used to go along to the office in Great George Street and see his friends from time to time.

"When my father came about the office," Robert said once, "he sometimes did not well know what to do with himself.

So he used to invite Bidder to have a wrestle with him for old acquaintance' sake. And the two wrestled together so often, and had so many 'falls' (sometimes I thought they would bring the house down between them) that they broke half the chairs in my outer office. I remember once sending my father a joiner's bill of about £2 10s. for mending broken chairs."

He did not mention what his clients thought when they called upon the most important engineer in England and found two respectable black-coated gentlemen wrestling among the chairs in the office. Whatever his father chose to do suited Robert perfectly.

But the friends George really cared about, and all his other interests, were now at Chesterfield. In these later years he often spoke at Mechanics' Institutes, for the people he liked best to help were young men in whom he saw a likeness to his own younger self. He could not do enough to encourage intelligent and industrious workmen who were determined, as he had been, to get on. Anything that he could do to ensure that their upward climb would be shorter and less laborious than his own, he was glad to do. He would never admit that there was any quality in his own rise to fame and fortune except hard work and perseverance. He would have agreed heartily with the saying that "Genius is one per cent inspiration and ninety-nine per cent perspiration", except that he might have doubted the necessity for the one per cent.

"I stand before you," he said once to a Mechanics' Institute, "but as a humble mechanic. I have risen from a lower standing than the meanest person here; and all that I have been enabled to accomplish in the course of my life has been through perseverance. I say this for the purpose of encouraging youthful mechanics to do as I have done—to persevere."

"Persevere" was his favourite word. It was the keyword of his teaching to his "lads"—those apprentices who came into the locomotive factory at the age of sixteen, and went out into the world as engineers, many of them to do well, even famously.

"Learn for yourselves, think for yourselves," he said to

them over and over again; "make yourselves masters of principles, persevere, be industrious, and then there is no fear for you."

"He was not glib, but he was very impressive," was the verdict of one young man who heard him address a Mechanics' Institute, and who was so impressed by what he heard that he afterwards spent several years writing a biography worthy of such a man. This was Samuel Smiles, whose "Life of George Stephenson" is a model of what a biography should be, and can never now be bettered.

Stephenson was an inspiration to many people besides Smiles. He had never been sorry for himself, that his life had not at first been cast in pleasant places (except perhaps once, that evening long ago, when he wept on the road home from the colliery), and he did not encourage others to be sorry for themselves. But he did encourage them to work for better things. Over and over again he told his own story, honestly proud of it, and glad if others could profit by his example and experience.

"It was worth crossing the Atlantic to have seen Stephenson alone, he had such native force of character, and vigour of intellect," was the verdict of the American writer, Emerson.

He died in August 1848, at the age of sixty-six, and was buried in Trinity Church, Chesterfield, where there is a tablet to his memory. His funeral was attended by a great number of his workpeople, relations, and friends, and even the shopkeepers of Chesterfield put up their shutters for the day.

Robert was broken-hearted, and never felt quite the same about anything again. He had adored his father all his life, and now adored his memory. He had lost his wife, he had no children, and in spite of his busy life and his many friends, he felt lonely. He was the acknowledged head of his profession. Since his father's death he was a millionaire—the first engineer millionaire. He was much courted and much flattered and not yet forty-five years old. But when his father died much of the light went out of life. The glory was departed. To his very last days, George had had such a capacity

for enjoying life, for looking hopefully forward and thankfully backward, such zest and enthusiasm even in his quarrels, that the future, to Robert, standing beside his grave, looked very grey and bleak.

It was not suggested that George should be buried in Westminster Abbey. There was not even a national memorial of any sort to him. To the end he remained something of an outsider to the more conventional part of the country. The faint shadow of his amateur status clung to his name. But a fitting tribute appeared in the obituary columns of the *Athenæum*:

> "His mechanical genius was of that order that it may without exaggeration be asserted that if Watt had not previously invented the steam engine, he was capable of achieving it. Others before him had prepared the way; others since have contibuted various improvements in detail; but to George Stephenson unquestionably belongs the proud title of the Author of the Railway System. He gathered the many threads of ingenuity and enterprise, and weaved them into the wide-spreading network which promises in its manifold extent to envelop the whole world in bonds of commerce, civilisation, and peace."

CHAPTER XIII

TRAVELLING BY TRAIN

At the date of George Stephenson's death travelling by train had already become an accepted part of the English pattern of life. Although it was the Great Exhibition of 1851 which opened people's eyes to the full possibilities of cheap travel as a means of improving the working-man's lot, excursions were by no means an invention of that year. As early as 1841 Mr. Thomas Cook arranged an excursion from Loughborough to Leicester for the members of a Temperance Club in which he was interested. The fare was a halfpenny a mile, and the thing was such a success that Mr. Cook was soon asked to arrange more journeys of the same sort, and in time he took to it as a profession and founded the famous travel agency which bears his name. But on the whole, in the early years, the railways catered for those people who used to use the stage-coaches —professional and middle-class people. The poor were not encouraged to travel, and the aristocracy continued to use their own private carriages. They disdained the mixed society of the railway carriage just as they disdained the common coaches. On the occasions when they did use the line, they very often had their carriage mounted on a flat truck and towed at the end of the train—a highly dangerous proceeding which was soon discouraged by the railway companies. Royalty patronised the railway very early, but then royalty travelled by special train, and everything was done to make its transit smooth and safe.

In 1843 the following table of average speeds was included in a paper read before the Statistical Society:

Lines on which the Trains Travel at the Greatest Speed

Northern and Eastern . . .	36 m.p.h.
Great Western	33 ,,

Newcastle and North Shields . .	30 m.p.h.
North Midland	29 „
Birmingham and Derby . . .	29 „
Midland Counties	28 „

These figures represented the average speed of all first-class trains, excluding stops, which were frequent, owing to the necessity of replenishing the water-tanks. It must be admitted that, looking at such a table, and considering how much had been accomplished in the fourteen years since the building of "Rocket", we have little enough reason to despise our great-grandfathers.

On February 24th, 1848, the London-to-Glasgow express did the journey in ten hours twenty-two minutes, or at an average speed of forty-six miles all the way, including stops. This was an isolated feat. It was not possible to schedule trains to run at such a speed over such a distance, but it showed what could be done only eighteen years after Rainhill.

According to Mr. Bradshaw's Railway Guide for March 1848 (or "Third Month", as the Quaker author preferred to call it), passengers by the 10 a.m. express out of Euston reached Glasgow at 1.40 next morning, or in 15 hours 40 minutes, after many stops and some changes on the way. This in itself was a great improvement, as the Bradshaw for the month before shows that it was impossible to reach Glasgow before 5.40 a.m., nineteen hours after leaving London.

Fifty years later, in March 1898, the 10 a.m. "Scotch Express" reached Glasgow at 6.45 p.m., or in 8 hours 45 minutes. On the way it made four stops of five minutes each at Willesden, Rugby, Crewe and Carlisle, and a twenty minute stop for lunch at Preston.

Fifty years later still, in March 1948, the same train, now christened the "Royal Scot", reached Glasgow five minutes later, at 6.50 p.m., in spite of stopping only three times, at Rugby, Crewe and Carlisle.

Remarkable as were the attainments of the lines to the north, even better results were shown on the broad-gauge Great

Western. On Brunel's magnificent line the "Iron Duke", "Tartar", "Swallow" and others of their class went roaring down from Paddington through Swindon to Bristol. The stability of the seven-foot way, the easy gradients, and the huge driving-wheels with which the broad-gauge engines were furnished, encouraged the breaking of records, even though the frequent stops for water made very high average speeds impossible over long distances. The normal speed of a Great Western express in 1848 over the fifty-three miles between Paddington and Didcot (not occasional speed, but the speed scheduled and shown in Bradshaw's Guide) was sixty miles an hour.

In the same year the best train of the day between Paddington and Bristol took 3 hours 20 minutes, in spite of several stops for water and the statutory ten minutes for refreshments at Swindon. One hundred years later, the best train to Bristol took 4 hours 10 minutes. One of the Great Western drivers even volunteered, if the railway directors would look after his wife and children, to take his engine to Bristol (118 miles) within the hour, but the gallant proposal was not accepted.

Naturally there were plenty of people who did not approve of these speeds. One ingenious gentleman, in a letter to the papers, suggested that twenty miles per hour was quite fast enough, and, as a check on over-enthusiastic drivers, "the whistle might be blown (i.e. utter a slight sound) at every *quarter* or *half-mile*, being worked by the driving wheel", so that the passengers could estimate the speed of the train, and report if it went too fast.

The best speeds were made by light "specials". The Queen took some time to become acclimatised to the railway, but Prince Albert travelled up and down to Windsor on the Great Western as soon as it was opened, and although it was reported that he occasionally used to say after a journey "Not quite so fast next time, Mr. Conductor, if you please", some of his "specials" did some surprising things. As early as July 1843, he came up from Clifton to Paddington in three

hours, which meant an average speed of forty miles an hour throughout, including stops.

It was not only royalty who went about by special train. It was nearly as simple a matter to charter a " special " as to hire a cab. It was quite frequently done by busy people who had missed their train. They simply hired a special and chased the train along the lines until they caught up with it. With the greater press of traffic and more crowding on the rails, this habit of private persons hiring a train to themselves had to be discontinued, but in the early days mail, despatches, race-horses, royalty and foreign visitors, as well as any Tom, Dick, or Harry who could afford the price, were whirled about the country in specials at most uncomfortable rates, rattling like dried peas in the little four-wheeled carriages.

The first-class carriage of the forties was much like three stage-coach bodies fixed on to one chassis. They were evolved from stage-coaches just as the first motor-cars were evolved from horsed carriages. An average carriage was fifteen feet long, six wide, and less than five high (from the floor, not from the ground level). It was no more possible to stand up inside than it is in a motor-car. There were six places in each compartment, and though these were rarely all filled —the companies reckoning to provide twice as many places as passengers—they must sometimes have seemed very crowded, since ladies' skirts were rapidly developing into the huge, bell-like crinoline. Corridor trains equipped with lavatories were very far in the future, and only developed with the long-distance non-stop engine. As late as 1890 there were no corridor carriages of the type we know, and a writer of that time protests that he infinitely prefers " the lonesome stuffy compartments " of the English train to the American " open car ". He does not mind in the least, he says, going without a lavatory for three hours at a stretch, but he cannot bear the long Pullman carriage, which entails " the privilege of the conversation of the general public ". The Queen's special coach, when she used to travel to Balmoral in the fifties and sixties, was fitted with a lavatory, but there was no such luxury

for her ladies, and the train used to make special stops in suitably lonely places.

Sleeping-cars were an earlier innovation. It was already possible in the 1840's to have a sleeping compartment of a sort if one travelled by the mail-train. The Post Office, like most Government Departments, was conservative, and it was slow to accept the railway as a suitable means of transport for the mails. In many places mail-coaches were kept on the road long after the ordinary stage-coaches had been driven off by railway competition, and in 1841 the inhabitants of Brighton complained in an indignant memorandum that they thought it neither " safe nor respectable " to have their mail sent down from London in a common cart, merely because the Postmaster-General refused to patronise the very excellent railway line which had driven all the coaches off the road. When the Postmaster-General did accept the railway as a suitable means of transport for the mail, the fast mail-trains on the long-distance lines—for instance, London to Liverpool—ran by night. They were faster and more expensive than the ordinary expresses, for in the early days, not unreasonably, speed as well as comfort was taken into account when fixing train fares. The faster you went the more you paid. For this reason first-class and third-class carriages were rarely found on the same train.

On the mail-trains the mail-bags were carried under the floors of the specially built carriages. Other Post Office carriages were already made to be used as sorting offices.

> " The mails should be fitted up in conjunction with the Post Office authorities [said an early writer, describing the London and Birmingham Railway]. One sort of those now used are divided into two parts. The first is a sleeping room, where two hammocks are hung up; the other is an office fitted up with drawers and pigeon-holes, for the purpose of sorting the letters. Three men are employed, so that by night two are in bed, and one at work, who is in turn relieved by the others; but the nature of this service will, of

course, vary with the length of journey and quality of the correspondence."

He goes on to describe the ordinary sort of mail-trains, which only carried the letters without sorting them. These were:

"made narrower than the other carriages in the body, and are placed on a platform over the double framing. The centre coach carries four persons inside. The first coach is built as a coupee, carrying only two persons, and the hinder part will carry either four persons sitting or two lying down. The fares, of course, correspond with the accommodation. In the bed carriage it would be double, every person occupying the usual seats of two. The carriage is divided into two parts longitudinally, so that each person lying down has half the carriage to himself; but, if two persons take this half, their fare should be lowered in proportion. The bed is made by placing a third cushion fixed to a board, which slides in between the two opposite seats, filling up the place where the legs of the passengers were. A door then lifts up at the back of the carriage, from the seat upwards, and fastens to the roof. This door opens into a boot which is fixed behind the mail, and into the opening go the feet of the person, the total length being about 6 feet 4 inches. A stuffed hair pillow is also provided."

The writer, a railway engineer himself, suggested that these rather spartan "sleepers" could be made really comfortable with sheets and blankets and the opportunity for the passengers to go to bed, instead of just lying down in their clothes. He was a person of imagination, and suggested also refreshment cars, invalid carriages, corridors, lavatories, and many other refinements which were not seen on English trains for many years after. He considered that a smoking-car should be attached to every train, "smoking", as he said, "having now become a necessity of life to many people." One company did run a compartment for smokers, which it called "the Divan",

but on most of the lines smoking was still one of the deadly sins, punishable with the utmost rigour of the law.

The *Mechanics' Magazine* related how a foreigner on the train from Brighton to London insisted on finishing his cigar in spite of a warning from the guard. Retribution was swift. At the next station he was turned out of the train, and the stationmaster told that he was not to catch any other London-bound train that day. The unfortunate man had the choice of cooling his heels in the waiting-room until next morning, or trying to find some other conveyance. No doubt, if the unhappy foreigner had gone the right way about things, instead of defying the all-powerful guard, he could have had all the cigars he wanted in perfect peace. The price of acquiescence, it was said, was half a crown, " so as to change his surly ' No smoking allowed, Sir,' to a subdued whisper of ' Be kind enough, Sir, to hold your cigar down as we pass the different stations '."

But although passengers were not allowed to smoke, they were encouraged to eat. There were frequent pauses for refreshment. The engine took in water while the passengers took in pork pies, pasties, cakes, tarts, bottles of ale, and cups of coffee. Half-way between London and Birmingham, for instance—at Wolverton—there were some renowned and magnificent refreshment-rooms with " seven very young ladies to wait upon the passengers ". Both Wolverton and Swindon were " half-way houses " on their respective lines, at which every train, from the first in the small hours of the morning to the last just before midnight, both up and down, stopped for ten minutes. At least, they were supposed to stop for ten minutes. Sometimes they stopped for half an hour. Sometimes, when they were behind schedule, they barely stopped at all. *Punch*, a champion of the welfare of the British people, and a perfect mine of interesting and amusing information about the early railways, complained on one occasion most bitterly about the injustice of " three minutes for scalding soup " at Swindon.

Wolverton, where the refreshment-rooms were run by the

Company, that " mirror of railways ", was generally described in glowing terms, but there is a familiar ring about a plaintive letter to the chairman of the Great Western, complaining that at Swindon the only food provided consisted of " pork pies (probably stale), sausage rolls and banbury cakes ", and that the writer and two friends " disbursed 7s. 6d. in no time for pork pies and indifferent bottled malt liquor. One of my friends had an attack of indigestion on the road—and no wonder after such a meal."

Or this letter of 1842 from Mr. Brunel himself to the authorities:

" Dear Sir,

I assure you Mr. Player was wrong in supposing that I thought you purchased inferior coffee. I thought I said to him that I was surprised you should buy such bad roasted corn. I did not believe you had such a thing as coffee in the place; I am certain that I never tasted any. I have long ceased to make complaints at Swindon. I avoid taking anything there when I can help it.

Yours faithfully,

I. K. Brunel."

The Great Western Company very soon regretted its agreement with a firm of contractors who built the refreshment-rooms and maintained them free of charge. The contractors paid only a peppercorn rent to the Company, and made their profit (a large one, it would appear, from the indignant complaints) from the passengers. The Great Western, on the other hand, undertook for ninety-nine years to stop every train at Swindon, and to set up no rival refreshment-rooms between Paddington and Bristol.

But all this has concerned the first-class traveller. The seconds and thirds were treated very differently. The *Comic Bradshaw*, printed in 1848, thus described the different classes:

" *First Class:* The chief inconvenience peculiar to this class is that your fare will be about twice as much as you

ought in fairness to pay. You run, perhaps, rather less risk in this class than in the others, of having your neck broken; but you must not be unprepared for such a contingency.

"*Second Class:* In travelling by the second class, you will do well to wear a respirator, unless you wish to be choked with dust and ashes, from the engine close in front of you. Also, if you are going far, you are recommended to put on a diving-dress, like that used at the Polytechnic; because, if it should rain much during your journey, the sides of the carriage being open, you will have to ride in a pool of water. Your dignity must not be hurt, should you have for next neighbour a ragamuffin in handcuffs, with a policeman next him. The hardness of your seat is a mere trifle; that is the least of the annoyances to which you are judiciously subjected, with a view of driving you into a first-class train.

"*Third Class:* Make up your mind for unmitigated hail, rain, sleet, snow, thunder, and lightning. Look out for a double allowance of smoke, dust, dirt, and everything that is disagreeable. Be content to run a twofold loss of life and limbs. Do not expect the luxury of a seat. As an individual and a traveller, you are one of the lower classes; a poor, beggarly, contemptible person, and your comfort and convenience are not to be attended to."

It must be said, on behalf of the railway companies, that they did not run third-class trains for profit. The working of the line was reckoned on the basis of first-class trains, and if they threw in a few third-class ones here and there, it was purely as a generous gesture towards the lower classes, very few of whom wanted, or could afford, to travel anyway. Third-class travellers were not admitted to the same waiting- or refreshment-rooms, often not to the same platforms, as the first-class, and their travelling was done in open trucks without roofs and sometimes without seats.

"We do not feel disposed [said the *Railway Times*] to attach much weight to the arguments in favour of third-

class carriages with seats. On a short line little physical inconvenience can result from their absence."

These so-called carriages, or "Stanhopes", were not only uncomfortable, which a generation accustomed to the carrier's cart or its own feet could well put up with, but they were commonly tacked on to the end of some lengthy goods-train, and dawdled across country at any speed at all. None of the railways had more than a double set of tracks at that time—an up line and a down line—so the slow trains had to use the tracks when they were not needed for faster traffic, which usually meant in the middle of the night. In 1845 an Act of Parliament was brought in by a young man called Mr. Gladstone, then newly appointed President of the Board of Trade, decreeing that no passengers should be conveyed at a speed less than twelve miles an hour, and that every railway company had to run at least one train a day with covered third-class carriages, at a penny a mile, and stopping at every station. Before this Act and the so-called "Parliamentary" trains which were the result of it, a fine line like the Great Western, for instance, sent its third-class trains (or rather train, for there was only one in the twenty-four hours) along at a speed of eight to ten miles an hour. The third-class train from London to Taunton took sixteen hours over the journey, and left London at nine o'clock in the evening. There was only one third-class train from Euston during the day, and passengers who reached Birmingham on it at three in the afternoon (having left London the night before) had, if they wished to go on to Liverpool, to wait for fifteen hours, until six the next morning, when the third-class train on the Grand Junction Railway elected to start.

It is hardly necessary to add that on the long-distance lines third-class traffic was a negligible quantity, although on some of the shorter lines—Sheffield and Rotherham, for instance, or London and Blackwall, where there was a heavy local traffic of workmen and their families—the companies found that it paid them to convey the third-class passengers rapidly and com-

fortably. But the management was often horrified to find that when " Stanhopes " were attached to all trains, as they were on the London and Blackwall, the public misused them in the most unfair fashion.

" We were astonished to see ", said an engineer attached to the Blackwall line, " several most respectably dressed persons riding in the Stanhope compartments, which are intended especially for those who cannot afford to pay for better accommodation."

There was a strong feeling that this sort of thing was not playing the game, and some companies tried to prevent it. It was said that on the Manchester and Leeds Railway sweeps were hired to get in among the " most respectably dressed persons " and empty their bags on the floor. Pigs were sometimes encouraged to travel third-class for the same reason.

The second-class carriages were not much more comfortable than the third, although they travelled much faster, being frequently attached to the first-class trains. They were almost entirely open at the sides, and the roofs were merely flat wooden covers supported on poles.

> " A passenger by the second class carriages on the Manchester and Leeds [reported the *Leeds Mercury*] complains that himself and a female relative have caught a severe cold from the holes in the floors of the carriages, which admit currents of air to the legs of passengers; he asks if there is any use or object in these holes, except to drive passengers into the first-class carriages. We cannot answer him."

Travelling by train in winter was no joke, even in the first-class, although there were foot-warmers provided on some railways—long, flat, metal hot-water bottles which were put under the passengers' feet, and could be refilled at the intermediate stations on a long journey. For the drivers and firemen on their unprotected platforms, and for the guards, sitting up on top like the guard of a coach, winter could be a very severe trial indeed. There were stories of guards, on a frosty night, being lifted down from their frozen perch and found to be

frostbitten, or even dead from cold; but these cases were rare enough—much rarer than they had been in the days of the old coaches. It is unfair, although tempting, to compare any state of things with what comes after. The proper comparison is with what has gone before, and by comparison with the coaching days, the early railways were rapid and efficient. The plight of the poor third-class passenger, which excites so much pity, was almost precisely the plight of all travellers by coach. In fine weather the open carriages must have been very pleasant, if we may judge by the number of people from the first-class who chose, in summer, to leave their stuffy compartments and ride on top with the guard and the luggage. A man who had been a schoolboy in the forties remembered how he and his brother, on their way between Repton and Manchester, used regularly to sit on the roof with the guard, and how often they had been pulled down flat as the train approached a low bridge.

An even more privileged position (but this was in the very early days, discipline having tightened by 1848) was on the engine itself. "A place on the footplate of the engine was looked upon much like the box seat of a stage coach. A well-known passenger could have it for the asking, and half-a-crown would probably secure it for a stranger at any time."

An engine-driver who started working for the Newcastle and North Shields Railway when it was opened in 1839 said that "when he first got married it was no unusual thing for his wife to go with him on the engine to Shields, for marketing purposes".

In bad weather, especially on a fast line, the engine was a weather-beaten position. It was suggested by one kindly person that the men should wear spectacles of wire gauze to save them from flying cinders. Another suggestion was that there should be three men on the platform, the third to be armed with a small telescope for the purpose of keeping a sharp look-out ahead. Signals were still in a very rudimentary stage, and breakdowns were many, so that an engine-driver never knew what dangers in the shape of a derailed train or a

blocked track the next corner might produce. At first there were no other signals than those given by special railway police, who patrolled the line with flags. At its first opening the London and Birmingham Railway had 190 guards and station staff, and no fewer than 200 special constables " wearing a peculiar distinguishing costume ".

" Throughout the journey [says Roscoe's guide to the L.B.R.] travellers will have observed a number of policemen stationed along the Railway,—who not only prevent intrusion, but are charged with the important duty of keeping the road free of obstruction, and making signals as the train passes. The police are placed along the line at distances varying from one to three miles, according as local circumstances render it necessary. Each man has his beat and duties defined, and is provided with two signal flags, one of which is red and the other white: the white flag is held out when no obstruction exists; and, on the contrary, the red flag indicates that there is danger, and that the train must not pass the signal till it is ascertained that the cause of danger is removed.

" Each policeman, also, is furnished with a revolving signal lamp, to be used after dark; which shows, at the will of the holder, a white light when the line is clear; a green one when it is necessary to use caution, and the speed of the train be diminished; and a red light, to intimate the necessity of immediately stopping."

(" Immediately stopping ", however, was a misleading way of putting it. Such brakes as there were were very inefficient, and a train could slither for hundreds of yards before coming to a halt. The provision of a really safe and efficient brake was a problem which continued to face railway engineers for many years.)

The men with flags, the coloured discs, the flags and lamps on posts, used on various lines were all equally unsatisfactory. They were all worked by hand, one man to one signal, and the most willing policeman in the world could only answer for his own signal. The train which he had passed through

might have broken down round the next bend, and be presenting a perfect ambush for the next unsuspecting engine-driver. As the traffic became heavier, the problem increased in urgency. When exceptional traffic had to be dealt with in the early days, the usual practice seems to have been to couple all the available engines and trucks into one vast crocodile, perhaps half a mile long, and send it along with a blessing on the couplings.

In 1842, for instance, a vast crowd gathered at Edinburgh to see the young Queen, who was visiting the city, and the newly opened Edinburgh and Glasgow railway had its hands full.

> " In going back [reported the *Scottish Guardian* proudly] one train took over 1,500 people at once. Between carriages, wagons etc., the train consisted of 110 vehicles filled with passengers, propelled by five engines, four in front and one behind. . . . We doubt very much whether a similar feat has ever been performed on any railway in the kingdom, and yet it is nothing to what might be achieved in an emergency by the London and Birmingham Railway Company, which has between 90 and 100 engines and a proportionate number of carriages."

Accidents were extremely frequent, but on the whole not very serious. In 1841 twenty-four passengers were killed " while riding in the carriages and exercising proper caution ". In the next year the number dropped to five, although these figures do not include fatal injuries to the companies' servants, nor accidents caused by negligence on the part of passengers, which were always numerous. It was apparently very difficult for people to remember that they were not riding in horse-drawn carriages. The greater smoothness to some extent disguised the speed, and tricks which could be played at ten miles an hour with impunity proved fatal at thirty.

" Injured, jumped out after his hat ", is a common entry in the records, or " Fell off, riding on the side of the wagon ", or " Skull broken, riding on top of the carriage, came in collision with a bridge ", or " Fell out of a third-class carriage while pushing and jostling with a friend ".

"Of the serious accidents reported to the Board of Trade, [runs an official memorandum] twenty-two happened to persons who jumped off when the carriages were going at speed, generally after their hats, and five persons were run over when lying either drunk or asleep upon the line."

Collisions between trains were more frequent than serious, but there were some ugly accidents, notably one on the Great Western on Christmas Eve, 1841, when eight people were killed and seventeen seriously injured. This sad occasion broke the Great Western's fine record of three years' freedom from accident, one broken leg being the only injury to 3,000,000 passengers during that time. Someone suggested that a fat feather-bed should be inserted between each carriage to minimise the shock of collisions, and another suggestion, made in all seriousness, was that the engine ought to be at least a mile ahead, towing its train by means of a good stout rope. The ingenious person did not suggest how bends in the line were to be negotiated.

On the whole, in spite of *Punch's* cartoon of an undertaker offering his card, with a charming smile, to a prospective railway traveller, the railways did very well, and were a testimonial to the energy and courage of the age in which they were born. The giant spider-web of lines that by 1848 embraced all the counties and most of the towns of England was very young, and still growing. New problems were arising all the time and having to be solved without the help of experience, and the great army of railway servants had to be created and trained as they were needed, and some of their early practices were hardly calculated to inspire confidence in the nervous traveller.

"When a train stopped for anything", one of the first generation of railway guards said, some years after, "the brakesman had to go back a quarter of a mile; he was not to return till he was whistled in, and then he had to run in as quick as he could for fear he should be overtaken by a following train. I have run many a pair of shoes off in my time doing this."

There was another railway where, at one point on the journey, the engine had to be transferred from the front of the train to the back. To save time, the fireman would clamber over the back of the engine and uncouple it. Then, leaving its train behind, the engine dashed ahead into a loop, the fireman leapt off, changed the points, allowed the train to roll past under its own power, changed the points back, and the engine raced after its train to catch it up again on the main line.

> " The writer [of Vignole's life] can recollect the time when on the rather stiff incline from Cophull to Euxton on the North Union Line, the guard of the train would call to some of the men in the third-class carriages (or *trucks* rather, for such they were), ' Come, my lads, lend a hand to give a shove to the train just to start the engine '. In rough weather, too, the effect of a strong wind dead ahead of the train had often a decidedly negative influence on the starting power of the locomotive. . . . Occasionally, when some of the travellers would reach the booking office a little behind time, the station master, handing them a paper slip which in those days served as the ' ticket ', would say to them: ' Now, hurry yourselves—she's not long started, and if you look sharp you'll catch her up ! ' "

But we should not like our descendants to judge British Railways entirely from the drawings of Mr. Emmett, and we must not fall into the same error. If, in those early days, some companies behaved in the friendly unofficial fashion of country bus services, we must remember that that is precisely what they were. Dozens of small companies controlled perhaps six miles of line, with a couple of engines, fifty mineral trucks, and a few passenger coaches. They can hardly be blamed, and should not in fairness be jeered at, for not looking ahead to the days when they would be completely absorbed by the national spiders' web.

The most important improvement on the railways during the forties was the introduction of the electric telegraph. This revolutionary invention, first tried out on the London and

Birmingham Railway between Camden Town and Euston Square (Robert Stephenson was one of its earliest and most enthusiastic supporters), was properly installed on the Great Western, between London and Slough, in 1843. With the telegraph came the possibility of efficient signalling and immense strides forward in railway organisation. The signals were no longer isolated. They could all be linked with each other, and a breakdown on the line traced immediately through the signal-boxes.

The ordinary man in the street was not at first particularly impressed, and *Punch*, of course, saw the comic side.

> " In the papers the other day the public will have observed an account of the Electro-Magnetic Telegraph on the Great Western Railway, by which messages are sent up and down the line with extraordinary rapidity. The readers of *Punch* will be delighted to hear that the telegraph has been attached to the ' Wormwood Scrubbs, Kensington, Warwick Square, Paddington Canal, Shepherd's Bush, Little Western, and No Junction Railway ' which connects the two and a half milestone with a field in the Western suburbs. The telegraph has been constantly in full play—it is all play and no work on this secluded little line—since Thursday. We give a specimen of the messages.
>
> Kensington, 7.20 a.m. Has the policeman finished his breakfast ? No answer.
>
> Kensington, 11 a.m. How are you ?
>
> Wormwood Scrubbs, 11.5 a.m. Tol lollish.
>
> Kensington, 11.15 a.m. No passengers by any of the trains. Is it worth while to send one down empty ?
>
> Wormwood Scrubbs, 11.20 a.m. You must send something, for here's a man wants to go, and there's nothing to take him.
>
> Kensington, 11.30 a.m. The train has just started with nine boys, who have volunteered to go as passengers.
>
> Wormwood Scrubbs, 1.30 p.m. The train has arrived,

but you must send a scuttle of coals to keep the engine fire in.

Kensington, 1.35 p.m. The coals have started, and a kitchen poker.

Wormwood Scrubbs, 2 p.m. The coals have come to hand, but the poker fell off the engine just after it started.

Kensington, 2.30 p.m. The train has come in, but not the passenger who was expected.

Wormwood Scrubbs, 2.35 p.m. He changed his mind.

Kensington, 3 p.m. This is dull work. I'm off for the day.

(The clerk at Wormwood Scrubbs having been already ' off for the day ' there was no answer to the last message.)"

The possibilities of the " speaking wire " were brought home very strongly to the public within a few months. A man called John Tawell committed a murder near Slough and got away to London by the next train, satisfied that he had outdistanced pursuit by several hours, and could disappear in the vastness of London before the Metropolitan Police were on to him. But the murder was discovered, and information telegraphed to Paddington from Slough station. On the very primitive machine then in use, " Q " was a difficult letter to send. The signalling clerk, not wanting to waste any time, sent off his description beginning " A man in the garb of a Kwaker . . ." When John Tawell got off the express at Paddington, confident that he had used the most rapid means of communication in the country, the police were waiting for him with a warrant.

In spite of the inevitable growing pains, the railway in 1848 had grown to be a child of which any father might be proud. It was no longer a marvel, but an everyday part of ordinary people's lives, jeered at, in a friendly fashion, by *Punch*, grumbled at by those indefatigable people who write to the papers, but accepted and used by everybody. The standard of living of the working-classes rose with a leap. Cheap coal, fresh vegetables, cheap meat and milk poured into the large towns. The seaside holiday spread from the favoured few to

become a great national institution. The green fields of the country were within everybody's reach. There was sentimental regret for the glamour of the coaching days (a glamour which was largely imaginary, as a matter of fact), and this regret has been passed on down the years by the Christmas-card artists and the writers of semi-historical novels, but it is difficult to prove that the railways, on the whole, did anything but good. In spite of all his struggles, George Stephenson, unlike many other pioneers, had the satisfaction of seeing, before he died, the accomplishment of all, and more than all, that he had hoped for and worked for.

Perhaps the extent to which the railway had become an integral part of people's lives cannot be better illustrated than by quoting a charming hymn, current about this time, called "The Spiritual Railway".

"The Line to Heaven by us is made,
With Heavenly Truth the rails are laid;
From Earth to Heaven the line extends
And in eternal life it ends.

Repentance is the station,
Where passengers are taken in;
No fee for them is there to pay,
For Love is in itself the way.

God's word is the first engineer,
It points the way to heaven so clear;
Through tunnels dark and dreary there
It does the way to glory steer.

God's love the fire, his grace the steam
Which drives the engine and the train.
All you who would to glory ride
Must come to God, in Him abide.

Come then, poor sinners, now's the time,
At any station on the line;
If you'll repent and turn from sin,
The train will stop and take you in."

CHAPTER XIV

THE BRIDGE BUILDER

When his father died in 1848, Robert was the most famous and fashionable engineer in England, perhaps in the world. From that date onwards his fame increased rather than diminished, but he was known rather as a bridge-builder than a railway engineer.

His first large-scale essay in bridge-building was begun in the great year of railway mania, 1845. In that year, among many other projects before Parliament, the Stephensons had a proposed line from Newcastle to Berwick, the last link in the line from London to Edinburgh, which old George had been dreaming about ever since he made the Stockton and Darlington Railway. A rival scheme was also before Parliament, engineered by Brunel. It was planned to run farther inland than the other, and was moreover to work by that "gimcrack" method, as George called it, the atmospheric principle. Brunel, most imaginative of all the railway engineers, was a strong supporter of the most imaginative scheme for railway traction.

The atmospheric system had a piston in a tube between the ordinary rails. The piston exactly fitted the tube, which was air-tight. In front of the piston the air was exhausted by a stationary steam-engine, and the piston, pushed by the pressure of the atmosphere behind, was simply sucked along its tube, carrying the carriage which was attached to it along at the same time. Very good speeds had been attained, and the whole idea was quiet, clean, and, in the jargon of the time, "elegant". The chief difficulty was the problem of sealing the tube again after the train had passed, so that it was air-tight for the next one, and the Stephensons' chief objection to it was that, as George said:

"It is only the fixed engines and ropes over again, in another

form; and, to tell you the truth, I don't think this rope of wind will answer so well as the rope of wire did."

The Stephensons' line did win the battle before the Parliamentary committee, and incidentally killed the atmospheric principle, then in its heyday, for good and all. Within a few years there was not a yard of atmospheric line in the country. The Stephensons (either by native genius or sheer obstinacy, it is difficult to tell at this distance of time) had triumphed once more, as they had already triumphed over Brunel's broad gauge.

The Newcastle and Berwick Railway was not a particularly remarkable piece of work, but one of the bridges did attract a good deal of notice. This was the bridge over the Tweed at Berwick, called (or rather miscalled, since Berwick, although across the Tweed, is still in England) the Royal Border Bridge. There was nothing unusual about the form of the bridge, with its twenty-eight stone arches, but it was of very fine design and workmanship.

At the same time, and in his own town of Newcastle, Robert was at work on another bridge, this time quite novel in form. The High Level Bridge over the Tyne was an iron bridge, with the railway carried on top of the arches and the roadway slung below. This new idea probably did not originate with Robert, any more than the steam blast and the multi-tubular boiler originated with his father, but the credit for developing and applying the idea is entirely his.

> "The result is a bridge that for massive solidity may be pronounced unrivalled. It is perhaps the most magnificent and striking of all the bridges to which railways have given birth, and has been worthily styled 'the King of railway structures'. It is a monument of the highest engineering skill of our time, and with the impress of power grandly stamped upon it."

The High Level Bridge marked the introduction of a new style of architecture, in keeping with the age of steel and steam, and deriving from the Egyptian or Babylonian style rather

than the arched Gothic and pillared Greek which had been hitherto the prevailing influence. It is Robert Stephenson's signature, boldly scrawled across the town he loved.

The railway age gave to engineers a fine chance to experiment in bridge-building. Between 1830 and 1845 as many new bridges were built as there had been before in the whole country. There were some notable successes. There were also a good many failures, as the following entertaining story

The High-level Bridge, Newcastle

from " The Life of C. B. Vignoles " shows. (Messrs. A, B, and C were three eminent engineers, whose names, unfortunately, the writer preferred to keep secret.)

" Mr. A. related that, on reaching his London offices one day, he received a report that another bridge had fallen. The sub-engineers in the department hearing of this, held a conference amongst themselves, and began to bet on ' whose bridge it was '. Heavy odds were laid on its being one superintended by Mr. X., who had earned a grim notoriety in this respect. But Mr. X. confidently denied it, and declared he would accept odds to any amount; and as this cooled the ardour of his brother engineers, he quietly

explained: 'I knew right well it could *not* be mine, as my last fell in a couple of days ago.' In the course of the same conversation, Mr. A. acknowledged to ten bridges that had failed on his (a very important) line. Mr. B. owned to fifteen or more, on another equally important line. On Mr. C. being asked how he had fared in this respect, he being the engineer of a line as notable now as it was then, replied: 'I really can't undertake to say how many bridges of mine have fallen down, but one has certainly failed *six times over*'."

When George Stephenson retired, he handed over to Robert, among other things, the Chester and Holyhead Railway. This was one of his favourite lines, for it was another link between two capital cities: Dublin and London. The line he surveyed followed close beside Telford's fine road, and, like the road, it had to cross the Menai Straits into Anglesey. This was a serious problem, for the Admiralty would allow no interruption in the shipping which used the Straits, so that an ordinary bridge was not possible. Telford had overcome this problem by a magnificent suspension bridge, opened in 1826. Stephenson's first idea was to use half the roadway of this bridge to carry the railway. A suspension bridge being less rigid than any other type (one sometimes sees notices ordering columns of troops to break step when crossing them, as otherwise the strain would be dangerous), the trains would not be able to run across normally. They would have to be broken up, and the carriages taken across by horses.

But by 1844, when the Act finally went before Parliament, railway traffic had increased so much in speed and frequency that it was obviously not going to be possible to use horses, even over a short stretch. Besides, the Government department responsible for roads and bridges refused to allow rails to be laid on the bridge except as a very temporary measure. Since the problem would have to be faced before very long, Robert decided to face it straight away.

No suspension bridge, it appeared, could be made sufficiently rigid to bear the great strain of a railway, so that method was

out of the question. Robert proceeded to draw up plans for a bridge of cast-iron with two arches. There was a place where the Strait was split by a rock in mid-stream, and the two arches could have their central pier on this rock without disturbing the deep-water channels on either side. The plan was rejected by the Admiralty, who would not allow the traffic to be interrupted by all the scaffolding that would be necessary during the building of the arches. Robert had half expected this answer, and he was already at work on another idea.

This was so revolutionary in conception that he hardly liked to consider it, but there seemed to be no other way. The principle of the bridge would be simply the primitive one of throwing a plank across a stream. He decided to build an immense iron girder from shore to shore and lay the railway track *inside* it. It could be supported in the middle, where the Britannia Rock made a solid base for a pier, but each span would have to be nearly 500 feet long—a terrifying prospect.

Robert thought it over for a long time.

"I stood on the verge of a responsibility," he said afterwards, "from which, I confess, I had nearly shrunk."

He was not in the habit of shrinking from responsibilities, and his common sense came to his rescue. A little calculation with pencil and paper showed satisfactorily that exactly the same principles of engineering applied to a bridge of that size as to one a tenth of the length, such as he had often built to cross canals and in other cases where an arch was undesirable. He laid his preliminary plans before the railway company, who were a little doubtful but trusted him.

There was no precedent or experience to help with this new type of bridge, so that a great deal of experimental work was necessary. Nearly a year was spent in patient research and model-making, and the bill for experiments came to £5,000. Robert would leave nothing to chance, and it was money well spent. He was cluttered up with railway business, for the mania was at its height, so he called in Mr. William Fairbairn, who knew more about iron than any other man alive, to find out what was the best and strongest form of girder for his

purpose. William Fairbairn had been a worker at Willington Quay and known George Stephenson well when Robert was a baby. He had often watched the engine fire in the evening so that George could put in an hour or two pitching ballast. He had climbed to prosperity almost as steeply and romantically as Stephenson, and was now a famous builder of iron ships.

Robert was at first in favour of a circular tube, which would present less surface to the wind than a rectangular one, but it was found that a circular tube would have to be braced so much internally that there would be no room for the trains. A rectangular tube was planned in the end, with two sides made not merely of iron plates riveted together, but of cells of iron plates—something like a section of honeycomb. In the spring of 1846 the bridge was begun, and so was a smaller one over the Conway river. Robert decided to make this of the same form, so that they could gain experience on it before tackling the bigger one.

The Britannia Bridge was to have five supports for its tubes —at the two abutments, two side towers on the edge of the water, and the central tower on the Britannia Rock. The abutments were built well back from the shore, so that the tube in the centre was relieved of some of the strain of its own weight. The longer the plank which crosses the stream, and the more it overlaps at each end, the steadier it is, and the less likely to tip or break when someone walks over it.

The tubes, when finished (there were to be two of them side by side, for the two lines of railway track), would each be 500 yards long, and weigh about 5,000 tons. The whole 500 yards was not to be built in one continuous piece. The side spans, between the abutments and the first piers, were to be built in their places, for it was possible to erect scaffolding. But the two centre spans, between the first piers and the middle pier on the rock, had to be built on the shore and then floated into position and raised to the requisite height. As each of these spans had to be 150 yards long, it was not an easy task.

A whole town of wooden shanties sprang up on the quiet

shores of the Straits. An army of workmen was imported, forges and workshops were built, steam engines constructed and scaffolding put up. The piers and the side tubes began to take shape, and the other great tubes were built up on pontoons. It was three years before the first tube was ready to be floated.

As the time drew near, Robert left all his other work in London and went to the Straits. The responsibility of the bridge weighed heavily on him. He slept badly, and worried all the time. He looked ten years older. He had never had

The Britannia Bridge

his father's sublime self-confidence even when he was young. He could not help worrying, even though he knew that he had taken all possible precautions to make the bridge as firm as possible. "Where one chain or rope was required, I provided two," he said. But the floating and lifting of the enormous girders was not something that could be safeguarded beforehand. The vagaries of wind and tide might play havoc with the best arrangements.

"Often at night I lay tossing about," said Robert. "The tubes filled my head. I went to bed with them, and got up with them. In the grey of the morning, when I looked across the Square, it seemed an immense distance to the houses on

the opposite side. It was nearly the same length as the span of my bridge."

It was a summer evening in 1849 when, standing on top of the first of the huge iron tubes, Robert gave the word to his men to float her off. Wind, tide, weather—everything had been calculated as minutely as possible. The tide carried the pontoons down towards the piers at what seemed a furious pace. The guide-ropes from the shore, attached to capstans manned by hundreds of sailors, held the moving mass steady in the water.

"The success of this operation [wrote Edwin Clark, the junior engineer, in a description of the bridge] depended mainly on the properly striking the 'butt' beneath the Anglesey tower, on which, as upon a centre, the tube was to be veered round into its position across the opening. This position was determined by a 12-inch line, which was to be paid out to a fixed mark from the Llanfair capstan. The coils of the rope unfortunately over-rode each other upon the capstan, so that it could not be paid out. In resisting the motion of the tube, the capstan was bodily dragged out of the platform, and the tube was in imminent danger of being carried away by the stream, or the pontoons crushed upon the rocks. The men at the capstan were all knocked down, and some of them thrown into the water, though they made every exertion to arrest the motion of the capstan-bars. In this dilemma Mr. Rolfe, who had charge of the capstan, with great presence of mind, called the visitors on shore to his assistance; and, handing out the spare coil of the 12-inch line into the field at the back of the capstan, it was carried with great rapidity up the field, and a crowd of people, men, women, and children, holding on to this huge cable, arresting the progress of the tube, which was at length brought safely against the butt and veered round. The Britannia end was then drawn into the recess of the masonry by a chain passing through the tower to a crab on the far side. The violence of the tide abated, though the wind

increased, and the Anglesey end was drawn into its place beneath the corbelling in the masonry; and as the tide went down, the pontoons deposited their valuable cargo on the welcome shelf at each end. The successful issue was greeted by cannon from the shore and the hearty cheers of many thousands of spectators, whose sympathy and anxiety were but too clearly indicated by the unbroken silence with which the whole operation had been accompanied."

It was done, and safely done. Robert heaved as heartfelt a sigh of relief as he had ever done in his life, and lit a cigar. All he wanted to do now was to go to bed.

The tube had still to be lifted into its place at the top of the piers, but this could not be done until hydraulic presses had been built. For the moment, with the pontoons taken away, the great tube hung just above the high-tide mark, out of harm's way. It fitted into its place perfectly. The immense girder had fallen into position with just three-quarters of an inch to spare.

The raising of the tube was a slow business. Robert, as cautious as ever, insisted on that.

"I knew the consequences of failure would be disastrous," he said, "and that the wisest economy was to provide for all contingencies at whatever cost. When the first tube had been successfully floated between the piers, ready for being raised, my young engineers were very much elated; and when the hoisting apparatus had been fixed, they wrote to me saying 'We are now all ready for raising her; we could do it in a day, or in two at the most'. But my reply was, 'No: you must only raise the tube inch by inch, and you must build up under it as you rise. Every inch must be made good. Nothing must be left to chance or good luck'."

They had reason to bless "the Chief's" caution before the job was over, for one of the hydraulic presses gave way, and the end of the tube fell. Instead of crashing to the water, it fell only nine inches, but even that nine inches represented £5,000 worth of damage.

"Thank God you were so obstinate," wrote the junior engineer to Robert, with more sincerity than politeness.

The spring of 1850 saw the opening of the Menai Tubular Bridge, and Robert drove the first train through the long tube. His only regret was that his father could not see the completion of the work, in which he had taken the greatest interest. Bridges were rather outside his scope—at least bridges on such a scale as the Britannia—but he was very proud of his son's achievements. And Robert, so long as his father was alive, always punctiliously referred to "*our* bridge over the Tyne" and "*our* work at the Straits", just as George had once written "Robert Stephenson, Engineer" on the plans for the Stockton and Darlington Railway.

With the opening of the Britannia Bridge, Robert decided that it was time for him to retire from the more strenuous part of his engineering work. He was only forty-six, but he had never been a strong man, and he had spent fifteen years in the most gruelling work, living on his nerves all the time. He had driven himself at a pace which few men could stand. His contemporaries who had worked at the same pressure retired young too. They had to, if they did not want to die of overwork.

Robert never completely retired, but after his great bridge he never undertook any other large-scale work in Great Britain, although he built railways abroad, and several more tubular bridges, of which the most famous was the Victoria Bridge at Montreal.

This great bridge had no single span as large as those of the Britannia, but the whole thing was much larger, being almost two miles from end to end. It had twenty-five great piers supporting the iron tube, through which ran the Grand Trunk Railway of Canada. It was opened in 1860, too late for Robert himself ever to see it finished.

The chief problem to be faced in building this bridge was the breaking up of the ice on the river every spring, and to protect the huge piers from the moving ice, each one was built with a sloping cut-water on the up-river side, constructed of ten-ton stone blocks.

"To convey some idea of the immense force which these piers are required to resist, we may briefly describe the breaking up of the ice in March 1858, while the bridge was under construction. Fourteen out of the twenty-four piers were then finished, together with the formidable abutments and approaches to the bridge. The ice in the river began to show signs of weakness on the 29th March, but it was not until the 31st that a general movement became observable, which continued for an hour, when it suddenly stopped, and the water rose rapidly. On the following day, at noon, a grand movement commenced; the waters rose about four feet in two minutes, up to a level with many of the Montreal streets. The fields of ice at the same time were suddenly elevated to an incredible height; and so overwhelming were they in appearance, that crowds of the townspeople, who had assembled on the quay to watch the progress of the flood, ran for their lives. This movement lasted about twenty minutes, during which the jammed ice destroyed several portions of the quay wall, grinding the hardest blocks to atoms. The embanked approaches to the Victoria Bridge had tremendous forces to resist. In the full channel of the stream, the ice in its passage between the piers was broken up in the force of the blow immediately on its coming in contact with the cut-waters. Sometimes thick sheets of ice were seen to rise up and rear on end against the piers, but by the force of the current they were speedily made to roll over into the stream, and in a moment after were out of sight. For the two next days the river was still high, until on the 4th April the waters seemed suddenly to give way, and by the following day the river was flowing clear and smooth as a millpond, nothing of winter remaining except the masses of bordage ice which were strewn along the shores of the stream."

The piers were found to have stood up to the ice with very little damage, and the bridge was completed with a strong feeling of confidence in its ability to stand up to anything the St. Lawrence could do.

Robert was not idle when he had partly retired from engineering. He had been Member of Parliament for Whitby since 1847, and although he spoke little, and then only on subjects within his own province, he went down to the House fairly regularly, and dutifully voted as the Whips told him to. He was no politician, and his election had merely been a nice compliment to a man of intelligence and sterling character. He was a Tory by nature rather than conviction, distrusting the mildest of Liberalism as though it were Anarchy, but he had no use for party warfare, and he respected any man's opinion, if it were an honest one. The Newcastle Conservatives would have liked him to give up his Whitby seat and stand for their borough, but he refused.

"I should have to ask many of my friends to vote for me at the expense of their political convictions," he said, "and that I could not stoop to do."

His Parliamentary career is chiefly memorable because he was hotly against the Suez Canal scheme, which he considered quite impracticable. Although Ferdinand de Lesseps, the engineer of that great work, was a personal friend, Robert was never persuaded that the plan was anything but crackbrained —"a gimcrack", his father would have called it.

His maiden speech, which he did not make until three years after he had joined the House, was on the subject of the Great Exhibition, for which he was one of the Royal Commissioners. He had been a warm supporter of the scheme since the beginning, as early as 1844.

But though Robert's politics were not remarkable, he was a good influence in the lobbies. He was liked by everyone, whatever the colour of their convictions, and could carry on the deadliest warfare of opinion, as he had shown in his dealings with Brunel, without a trace of animosity. Everybody who ever spoke to Robert seems to have fallen under his charm—a charm arising from the genuineness of his nature. Nothing could spoil him, neither wealth nor flattery, both of which had been lavished on him over the years. And if sometimes he said one thing and did another, the discrepancy was usually in his favour.

He was known, for instance, to express the strongest views on the subject of too much education being bad for the working-man, who ought to keep his mind on the job in hand.

"It is all nonsense Lord John preaching and preaching education to the working classes," he said once. "What the artisan wants is special education for his own particular specialty. And the more he leaves everything else alone the better."

This has been made much of by some modern writers, to whom literacy is a god. "Robert Stephenson had little of the geniality and unpretentious simplicity of his father," writes one of them. "He belonged to a harsher, more selfish type, which despised the very class from which it had sprung."

Even if his views on education were so very reprehensible, it is difficult to show that he stuck to them in deed. When the Newcastle Literary and Philosophical Institute was cumbered with a debt of £6,000, he not only offered it half the sum, which might have been mere sentimental gratitude, but he also made the proviso that the Institute should cut its annual subscription by half, so that more people, and poorer people, could afford to belong to it.

He was a very rich man since his father died. Old George, who had started at a shilling a week, had died worth many thousands, and had left them all to his son, and Robert's own professional income, at the height of his career had been somewhere in the neighbourhood of £30,000 a year. But having neither wife nor child, and not very elaborate tastes, he did not care particularly for money. He entertained at his house in Gloucester Square, it is true, but his favourite form of entertainment was a quiet Sunday lunch-party of his fellow-engineers. He had bought a few statues and commissioned one or two pictures, but he was no art critic. The pictures he liked best were those of his bridges, accurately depicted, and the portrait of his father.

While Fanny was alive it had been different. She had had leanings towards high society, and had made him go to the Heralds' College and buy himself a coat-of-arms to which he had not the slightest right, but for which he paid liberally.

He hated the transaction, for he was never a victim of snobbishness in any of its forms. Once, when his eye fell on the mixture of fleur-de-lys and mullets which the Heralds' College had concocted for him, he blushed like a schoolboy, and said: "I wish I'd never adopted that foolish coat-of-arms. Considering what a little matter it is, you would hardly believe how much I have been annoyed by that silly picture."

But it had been Fanny's wish, and Fanny's wish had been law. No doubt, if she had been alive, he would have accepted the knighthood that was offered to him in 1847. Himself, he had no use for any such "flourishes", as his father would have said, and refused it.

"I never in my life knew a more *clubbable* man than Robert Stephenson", one of his friends summed him up, and the fact was proved by the scores of his friends. Without them, the end of his life, without wife, without children, without his beloved father, and living in a very different sphere from most of his relations, would have been very lonely. The only one of his many cousins who was a close friend was the elder Robert Stephenson's son, George Robert (always so called to distinguish him from all the other Georges and Roberts). He had started his career in a coal-mine at the age of twelve, but had graduated into civil engineering, and now shared the offices in Great George Street. It was he who carried out the work on the great Victoria viaduct for Robert.

Robert had few relaxations. He had been brought up from such an early age with his nose to the engineering grindstone, and had worked so hard and so consistently all his life, that he had had little time to pick up hobbies on the way. He had no country house and few interests out of town. After his semi-retirement in 1850, however, he developed a passion for the sea, and had a yacht built, a magnificent schooner with a crew of sixteen and room for a dozen or more guests, large enough for long sea voyages.

"I find I can get no peace on land [he wrote to a friend]. I am therefore preparing another sea lodging house. I find it

no easy matter to get rid of a multitude of questions which follow on a tolerably long professional life. Indeed I find that nothing gives me actual freedom from attack, but getting out of the way of the postman. The sea, therefore, is my only alternative. Ships have no knockers, happily."

The *Titania* did not last very long. About two years after she was built, George Robert, who had the use of her whenever he liked, wrote to the captain telling him to get the yacht ready. Fires were lighted aboard, and when he and his family arrived at Cowes, they found that the boat had caught fire and was most thoroughly gutted. He hurried back to London in no very pleasant state of mind, to break the news to the boat's owner.

"What brings you here? What's the news?" said Robert cheerfully, when his cousin arrived in the middle of a dinner-party.

"Bad news, Robert. I ordered the *Titania* to be got ready for me, to take me and my family a few days' cruise; and—she's burnt to the water."

At the sight of his cousin's distress, Robert swallowed his own.

"Well, well, man, don't be annoyed. You couldn't help it," he said. "Sit down and have your dinner. We'll talk about it afterwards over a glass of wine."

George Robert did not feel particularly hungry, but he managed to get through the evening somehow until he and Robert were alone and could talk about the accident.

"Never mind, old boy," said Robert, as consolingly as though the boat were not his at all. "We'll have a much finer boat than the old *Titania* before we're much older."

Like his father, Robert loved going to Newcastle to see how the factory was going on and to meet old friends. Sometimes he wished he had never left the factory but had remained a mechanical engineer to the end of his life.

"That's the Robert Stephenson I'm most proud to think of," he would say, remembering the days when they had built

" Rocket " and the little team of engines for the Liverpool and Manchester. And the men at the works were proud to think of him too. Even the old dog at the gate woke up from his place in the sun and went to lick Robert's hand as soon as he heard his step in the lane.

When he had retired he could go about things in a more leisurely fashion, and he went with two friends to spend a longish holiday in Newcastle. When he had attended to the factory and all his business in the town, they went out to Killingworth, and all the way along the familiar road Robert remembered and remembered, until he forgot that he was a middle-aged gentleman with grey hair, and began to talk the broad Northumbrian of his youth.

At the West Moor, where the tramway crossed the road beside the cottage (Robert was glad to see that the old black engines were still at work with their strings of coal trucks) an old man was standing by the level crossing, working the gate.

" How long have you been here ? " said Robert, not recognising him.

" Why, forty years and more."

" And what do they call you ? "

" They call me Clark," said the man, " but who are you ? "

" I'm Robert Stephenson."

" Robert Stephenson ? "

" Ay, George's Robert."

" Eh, man," said the old gate-keeper, taking both his hands as though he would never let them go, " but I'm right glad to see you. I've boxed your ears many a time, for you were never out of mischief when you used to fetch your father's dinner to the pit-heap."

It was the same everywhere he went. Everyone was delighted to see " George's Robert ", but none of them recognised him until he told them who he was. He was ill, and thin, and grey, and they hesitated to put a name to his half-familiar face.

" Why," said one old friend, after a puzzled look, " it must be Robert Stephenson."

" Ay, my lad," said Robert sadly, " it's all that's left of him."

The cottage with the sun-dial was occupied by people who had never heard of the Stephensons, but the woman who opened the door asked Robert in very pleasantly when she heard that he had once lived there. In the living-room there still stood the desk with the bookshelves above, at which he had done his homework every evening. Built in the room, it had been impossible to move away, and had gone with the house to the next tenants.

" Do you know there is a secret drawer in that desk ? " said Robert.

" It has no secret drawer," said the woman.

" Oh, but it has," said Robert. " I know it has, for my father made it."

He pressed the catch, and the drawer opened under his hand, but there was nothing inside to remind him of the years gone by—nothing but a little dust in the corners.

Soon after he returned to London from that visit, which had been so pleasant and so sad, he received a note from his friend Brunel asking him to come and help launch his wonderful new iron ship, the *Great Eastern*. Brunel, true to his character, could not build a ship without making it the finest of its kind, with the result that the *Great Eastern* was ahead of its time by at least half a century, a costly and magnificent failure. When Robert had been floating the tubes for the Britannia Bridge, Brunel had been beside him as moral support. Now Robert went down to the London docks and spent a long day paddling about in the Thames mud while they tried to get the great ship launched, without success. It was bitterly cold, he would never wear an overcoat, and he fell off the edge of a piece of timber and got wet up to the waist. But the operations were much too interesting to leave.

" Never mind me ; I'm quite used to this sort of thing," he said, when someone tried to persuade him to go and change.

The result was inflammation of the lungs, which only kept him in bed for a fortnight, but caused a further deterioration in his already poor state of health.

While he was confined to the house, he heard that the launching of the *Great Eastern* was completed after many difficulties, and he hastily scribbled a note to Brunel:

"My dear Brunel:—I slept last night like a top, after I received your message. I got desperately anxious all day, but my doctor would not permit me to venture so far away as Millwall.

I do, my good friend, most sincerely congratulate you on the arrival of the conclusion of your anxiety.

Yours sincerely,
Robert Stephenson."

He had lived too hard and too fast to make old bones, and died in the autumn of 1859, a few days before his fifty-sixth birthday. They buried him in Westminster Abbey beside Thomas Telford, and all the shipping on the Thames and the Tyne flew their flags at half-mast. In Newcastle all the workmen from the factory—some 1,500 of them—decided to show their respect for the dead man in their own way, and at the hour of his funeral they marched to the parish church in procession for a service of commemoration.

The obituary notice in the *Illustrated London News* said:

"Mr. Stephenson was beloved by all who knew him. He was a most generous man, without a particle of meanness in his nature. He was generous to his contemporaries, and kind and forbearing to those under him. He was withal modest and retiring, avoiding ovations where he could, and shunning publicity. Above all, he was an honest man."

Isambard Kingdom Brunel, for so long his rival and his friend, had died three weeks before. He was two years younger than Robert, but he could not survive the strain of making his great ship. The third of the "triumvirate", Joseph Locke, also in his early fifties, survived no longer than the next year.

The pioneer railway builders were dead, and the heroic age of the railways was ended.

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The Science Museum is a mine of information. Besides original locomotives and models, it has an excellent collection of prints, Stephenson relics, and various other things, including a holograph copy of the letter from John Dixon to his brother (see pp. 109, 110).

AUTHOR'S NOTE

ANYONE who writes about the Stephensons must rely very much on *The Life of George Stephenson* by Samuel Smiles, which in its later editions was expanded to cover Robert's life as well. I have nowhere invented words to put into people's mouths. Most of the conversations are to be found in Smiles. I have only taken the liberty of translating into more standard English his attempts to render broad Northumbrian, and occasionally I have put into direct speech words that he reported. Quotations of more than a few words used in the text without acknowledgment are taken either from Smiles or Jeaffreson.

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